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PROGRESS REPORT 5
SEPTEMBER, OCTOBER, NOVEMBER 1975
GEOTECHNICAL DATA GATHERING PROJECT
HYDROLOGIC PROGRAM
SECTION 1.2

INTERPRETIVE TEXT

FEBRUARY 20, 1976

TO
AREA OIL SHALE SUPERVISOR
UNITED STATES GEOLOGICAL SURVEY

By
WRIGHT WATER ENGINEERS, INC.
For
GULF OIL CORPORATION
And
STANDARD OIL COMPANY (INDIANA)

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HYDROLOGIC PROGRAM, SECTION 1.2

SURFACE WATER DATA COLLECTION PROGRAM[1]

Station	Discharge		Water Quality		Precipitation		
	Instantaneous	Continuous	Data	Summary	Recording	Storage	Intensity
Box Elder Gulch near west line Tract C-a	R2,R3V1, R4	R5	R3V1	R4,R5		R4,R4V R5,R5V	
Dry Fork near west line Tract C-a						R4,R4V R5,R5V	
Corral Gulch near West line Tract C-a	R2,R3 R3V1,R4	R5	R3V1	R3,R4 R5		R4,R4V R5,R5V	
Corral Gulch east of Tract C-a	R3,R3V1 R4	R5	R3V1	R3,R4 R5			
Corral Gulch South of 84 Meas	R5			R5			
Stake Spring Draw near Confluence with Corral Gulch					R3,R3V1,R4 R4V,R5,R5V		R5V
Yellow Creek near White River, Colorado	R2,R3 R3V1,R4	R5		R5	R3,R3V1,R4 R4V,R5,R5V		R5V
Yellow Creek near Cathedral Bluffs					R3,R3V1,R4 R4V,R5,R5V		R5V

[1] LEGEND: Applies to Alluvial Aquifer Data & Deep Aquifer Data Program

R	RBOSP Progress Report, Hydrologic Program
V	RBOSP Hydrologic Program Raw Data Volume
A	RBOSP Progress Report, Hydrologic Program, Interpretive Text Appendix
e.g. R3V1	RBOSP Progress Report 3, Hydrologic Program, Raw Data Volume 1

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FOR RIO BLANCO OIL SHALE PROGRESS REPORTS 2 - 5

HYDROLOGIC PROGRAM SECTION 1.2

ALLUVIAL AQUIFER DATA

Test Hole	Drilling	Water Level	Water Quality Field Data pH, Cond. Temp.	Water Quality Lab. Analysis	Summary
S-6*					
S-7	R2A	R3,R4,R5	R3,R4,R5	R3V1,R4V,R5V	R3,R4,R5
S-8	R2A	R3,R4,R5	R3,R4,R5	R3V1,R4V,R5V	R3,R4,R5
S-11	R2A	R3,R4,R5	R3,R4,R5	R3V1,R4V,R5V	R3,R4,R5
S-12	R2A	R3,R4,R5	R3,R4,R5	R3V1,R4V,R5V	R3,R4,R5
S-13*	R2A				
S-14*	R2A				
S-15*	R4A				
S-16*	R4A				
S-17*	R4A				
S-18*	R4A				
S-19	R4A	R4,R5	R4,R5	R4V,R5V	R4,R5
S-22	R4A	R4,R5	R4,R5	R4V,R5V	R4,R5
S-23	R4A	R4,R5	R4,R5	R4V,R5V	R4,R5
S-24	R4A	R4,R5	R4,R5	R4V,R5V	R4,R5

* The test holes that are not referenced are dry, see Text R3, R4, and R5

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HYDROLOGIC PROGRAM, SECTION 1.2

DEEP AQUIFER PROGRAM DATA

	COMPLETIONS		GEOHYDROLOGIC DATA				
			AQUIFER		DRILLING		
					Geophysical		
TEST HOLE	Test Hole Cross Sections	Pump Installations	Hydrologic Cross Section	Aquifer Thickness Maps	Water Velocity, Water Movement & Temp. vs. Depth	Water Production	Informal Recovery Tests
AM-2A	R2A		R2	R4			
AM-3	R2A		R2	R4			
AM-4	R2A		R2	R4			
CE-701	R2A	R3	R2	R4			
CE-702	R2A		R2	R4			
CE-703	R2A			R4			
CE-705A	R2A	R3	R2	R4			
CE-707	R2A		R2	R4			
CE-708	R2A		R3	R4			
CE-709	R2A		R3	R4			
G-S 1	R2A		R2	R4	R2A	R2A	R2A
G-S 2-3	R2A		R2	R4	R2A	R2A	R2A
G-S 4-5	R2A	R3	R2	R4	R2A	R2A	R2A
G-S 6	R2A		R2	R4	R2A	R2A	R2A
G-S 7	R2A		R2	R4	R2A	R2A	R2A
G-S 8	R2A		R2	R4	R2A	R2A	R2A
G-S 9	R2A		R2	R4	R2A	R2A	R2A
G-S 10	R2A		R2	R4	R2A	R2A	R2A
G-S 11	R2A		R2	R4	R2A	R2A	R2A
G-S 12	R2A	R3	R2	R4	R2A	R2A	R2A
G-S 13	R2A		R2	R4	R2A	R2A	R2A
G-S 14	R2A		R2	R4	R2A	R2A	R2A
G-S 15	R2A		R2	R4	R2A	R2A	R2A
G-S D16	R2A	R3	R2	R4		R2A	
G-S D17	R2A	R3	R2	R4		R2A	
G-S D18	R2A	R3	R2	R4		R2A	
G-S D19	R2A	R3	R2	R4		R2A	
G-S M1	R2A		R2	R4	R2A	R2A	R2A
G-S M2	R2A				R2A	R2A	R2A
G-S M3	R2A				R2A	R2A	R2A
G-S M4	R2A				R2A	R2A	R2A
G-S M5	R4					R4	
TO 1	R2A		R2	R4			
TO 2	R2A		R2	R4			
T[illegible]	R2A		R2	[illegible]			

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HYDROLOGIC PROGRAM, SECTION 1.2

DEEP AQUIFER PROGRAM DATA

GEOHYDROLOGIC DATA							
	PUMPING TESTS				MONITORING PROGRAM		
TEST HOLE	WATER LEVEL DRAWDOWN DATA	SEMI-LOG DRAWDOWN PLOTS	TRANSMISSIVITY AND STORAGE COEF.	TRANSMISSIVITY AND PERMEABILITY MAPS	WATER LEVELS	HYDROGRAPHS	PIEZOMETRIC SURFACE MAPS
AM-2A	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
AM-3	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
AM-4							
CE-701	R3V3	R3A			R3V2	R3A,R4A	R4,R5
CE-702	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
CE-703							
CE-705A	R3V3	R3A	R3	R4	R3V2	R3A,	R4,R5
CE-707	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
CE-708	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
CE-709	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
G-S 1	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
G-S 2-3	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
G-S 4-5	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
G-S 6	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
G-S 7							
G-S 8	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
G-S 9	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
G-S 10	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
G-S 11	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
G-S 12	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
G-S 13	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
G-S 14							
G-S 15	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
G-S D16	R3V3	R3A	R3	R4	R3V2	R3A	R4
G-S D17	R3V3	R3A	R3	R4	R3V2	R3A	R4
G-S D18	R3V3	R3A	R3	R4	R3V2	R3A	R4
G-S D19	R3V3	R3A	R3	R4	R3V2	R3A	R4
G-S M1	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
G-S M2	R3V3	R3A	R3		R3V2	R3A,R4A	
G-S M3	R3V3	R3A	R3		R3V2	R3A,R4A	
G-S M4	R3V3	R3A	R3		R3V2	R3A,R4A	
G-S M5							
TO 1	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
TO 2	R3V3	R3A	R3	R4	R3V2	R3A,R4A	R4,R5
TO 3	R3V3	R3A	R3	R4	R3V2	R3A	R4

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HYDROLOGIC PROGRAM, SECTION 1.2

DEEP AQUIFER PROGRAM DATA

WATER QUALITY

	DRILLING		PUMPING TEST		MONITORING		
TEST HOLE	FIELD ANALYSIS COND., pH, TEMP.	LAB ANAYLSIS	FIELD ANALYSIS COND.,pH, TEMP.	LAB ANALYSIS	LAB ANALYSIS	SUMMARY OF LAB ANALYSIS	CHEMICAL CONSISTENT DISTRIBUTION MAPS
AM-2A		R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
AM-3		R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
AM-4		R3V1					R4;R4V
CE-701		R3V1				R3,R4,R5	R4;R4V
CE-702		R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
CE-703		R3V1				R3,R4,R5	R4;R4V
CE-705A		R3V1	R3	R3V1		R3,R4,R5	R4;R4V
CE-707		R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
CE-708		R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
CE-709		R3V1			R3V1,R4V1,R5V	R4V ,R5	R4;R4V
G-S 1	R2A	R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S 2-3	R2A	R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S 4-5	R2A	R3V1	R3	R3V1	R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S 6	R2A	R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S 7	R2A	R3V1				R3,R4,R5	R4;R4V
G-S 8	R2A	R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S 9	R2A	R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S 10	R2A	R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S 11	R2A	R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S 12	R2A	R3V1	R3	R3V1	R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S 13	R2A	R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S 14	R2A	R3V1				R3,R4	R4;R4V
G-S 15	R2A	R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S D16	R2A	R3V1	R3	R3V1		R3,R4	R4;R4V
G-S D17	R2A	R3V1	R3	R3V1		R3,R4	R4;R4V
G-S D18	R2A	R3V1	R3	R3V1		R3,R4	R4;R4V
G-S D19	R2A	R3V1	R3	R3V1		R3,R4	R4;R4V
G-S M1	R2A	R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S M2	R2A	R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S M3	R2A	R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S M4	R2A	R3V1			R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
G-S M5	R4	R4V1			R4V1,R5V	R4,R5	
TO 1					R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
TO 2					R3V1,R4V1,R5V	R3,R4,R5	R4;R4V
TO 3			R3	R3V1	R3V1	R3,R4	R4;R4V

1.2 HYDROLOGIC PROGRAM

The Rio Blanco Oil Shale Project is conducting the surface and subsurface Hydrologic Program to establish baseline hydrological conditions, to gather data for the design of mine dewatering and water right acquisition pertinent to Tract C-a development. RBOSP Progress Report 2 presented hydrologic data collected during the core hole drilling program; Progress Report 3 presented data obtained during the formal pumping tests. Hydrologic data, summary and analyses were discussed in Progress Report 4. The main purposes of this report is to update hydrologic data of the quarterly period from September through November, 1975.

RBOSP Progress Report 5 submits the data generated from the Hydrologic Program to the AOSS in two parts, the Interpretive Text and Raw Data. The Interpretive Text includes explanations of hydrological data collected in the field, analytical results of water samples by lab methods, and data from the gaging stations associated with Tract C-a submitted by the Water Resources Division of the U.S. Geological Survey. Raw Data volume contains computerized printouts of such measurements.

Subsurface hydrologic data collection began with the drilling and coring operations by RBOSP in July, 1974. Previous hydrologic baseline data collected in the area are contained in "Phase II, Preliminary Dewatering Analysis Report, Cameron Engineers, November, 1972" and "Phase II, Preliminary Hydrogeologic Report for AMOCO, December, 1973", and RBOSP Progress Reports 2, 3 and 4, Section 1.2 Hydrologic Program. Wright Water Engineers, Inc., Denver, Colorado, has been compiling the hydrologic data on behalf of RBOSP.

1.2.1 SURFACE WATER MONITORING STATIONS

In order to establish an environmental baseline for the surface hydrology, RBOSP has contracted with the Colorado River Water Conservation District to have the Water Resources Division of the United States Geological Survey construct and monitor eleven stream gaging stations and six rain gaging stations on or in the vicinity of Tract C-a. RBOSP Progress Reports 2 and 3 described the operation of the existing seven monitoring stations. The major activity under the Hydrologic Program during this quarter was the completion, by October 1, 1975, of four additional gaging stations located near the 84 Mesa. These four gaging stations are equipped with automatic samplers and are capable of monitoring continuous flow, temperature and conductivity. Instantaneous hydrologic data have been monitored at these four stations since April 6, 1975. The first water samples were collected on June 12, 1975. Instantaneous data were recorded by only two stations at Corral Gulch south of 84 Mesa and Lower Big Duck Creek north of 84 Mesa from April through September. The other two gaging stations remained dry during this period. Additional hydrologic data of these stream gaging stations will be included in the next quarterly report.

The continuous and automatically recorded data for the water year 1975 have been received from the USGS. They included continuous flow, temperature, and specific conductance of the following stations: Corral Gulch east and near west line of Tract C-a, Box Elder Gulch near west line of Tract C-a, and Yellow Creek near White River, Colorado. The continuous data which replaced the previous bi-weekly instantaneous data are presented in Section 1.2.2 of this report.

Table 1.2-1 gives the USGS identification numbers and locations of the eleven stream gaging stations and six rain gaging stations. Table 1.2-2 shows the data collection schedule.

TABLE 1.2-1

LOCATION AND USGS IDENTIFICATION NUMBERS FOR SURFACE AND RAIN GAGIN STATIONS

USGS Identification Number	LOCATION
09306237	Dry Fork near west line Tract C-a
09306235	Corral Gulch near west line Tract C-a
09306240	Box Elder Gulch near west line Tract C-a
09306242	Corral Gulch east of Tract C-a
09306230	Stake Springs Draw near confluence with Corral Gulch
09306255	Yellow Creek near White River, Colorado
09306241	"Rinky Dink" Gulch near east line Tract C-a
09306248	Upper Big Duck Creek north of 84 Mesa
09306250	Lower Big Duck Creek north of 84 Mesa
09306246	Tributary to Yellow Creek east of 84 Mesa
09306244	Corral Gulch south of 84 Mesa
	STORAGE-TYPE RAIN GAGES
09306235	Corral Gulch near west line Tract C-a
09306237	Dry Fork near west line Tract C-a
09306240	Box Elder Gulch near west line Tract C-a
	RAINFALL INTENSITY AND RECORDING RAIN GAGES
09306230	Stake Springs Draw near confluence with Corral Gulch
09306255	Yellow Creek near White River, Colorado
No number	Cathedral Bluffs located in NW¼, NW¼, Sec. 14 T2S, R100W

TABLE 1.2-2

DATA COLLECTION SCHEDULE FOR STREAM GAGING STATIONS

Continuously or Automatically

- Flow Rate
- Sediment Discharge
- Temperature
- Specific Conductance

Periodically

- Storage Rain Gages
- Recording Rain Gages
- Rainfall Intensity Gages

Semi-Monthly

Water Samples Analyzed For

- Barium
- Boron
- Calcium
- Chromium (Hexavalent)
- Copper
- Fluoride
- Iron
- Lithium
- Magnesium
- Potassium
- Selenium
- Silica
- Sodium
- Sulfate
- Zinc
- Ammonia
- Bicarbonate
- Carbonate
- Chloride
- Color
- Dissolved Solids
- Kjeldahl Nitrogen
- Nitrate
- Nitrite
- Odor
- Oil and Grease
- Turbidity
- Dissolved Oxygen
- pH
- Arsenic
- Cadmium
- Lead
- Manganese
- Mercury
- Total Phosphate
- Ortho Phosphate
- Cyanide
- Sulfide

Quarterly

Sample and Analyze

- COD
- Fecal Coliform
- Pesticides
- Polycyclic Aromatics
- Radioactivity
  - Gross Alpha
    - 4 Picocuries/l
    - Ra^{226}
  - Gross Beta
    - 100 Picocuries/l
    - Th^{230}
    - Uranium
- Spectrographic Scan
  - 67 Elements
- TOC
  - 10 mg/l
  - DOC
  - SOC
  - Phenols
  - Sulfur
  - Nitrogen

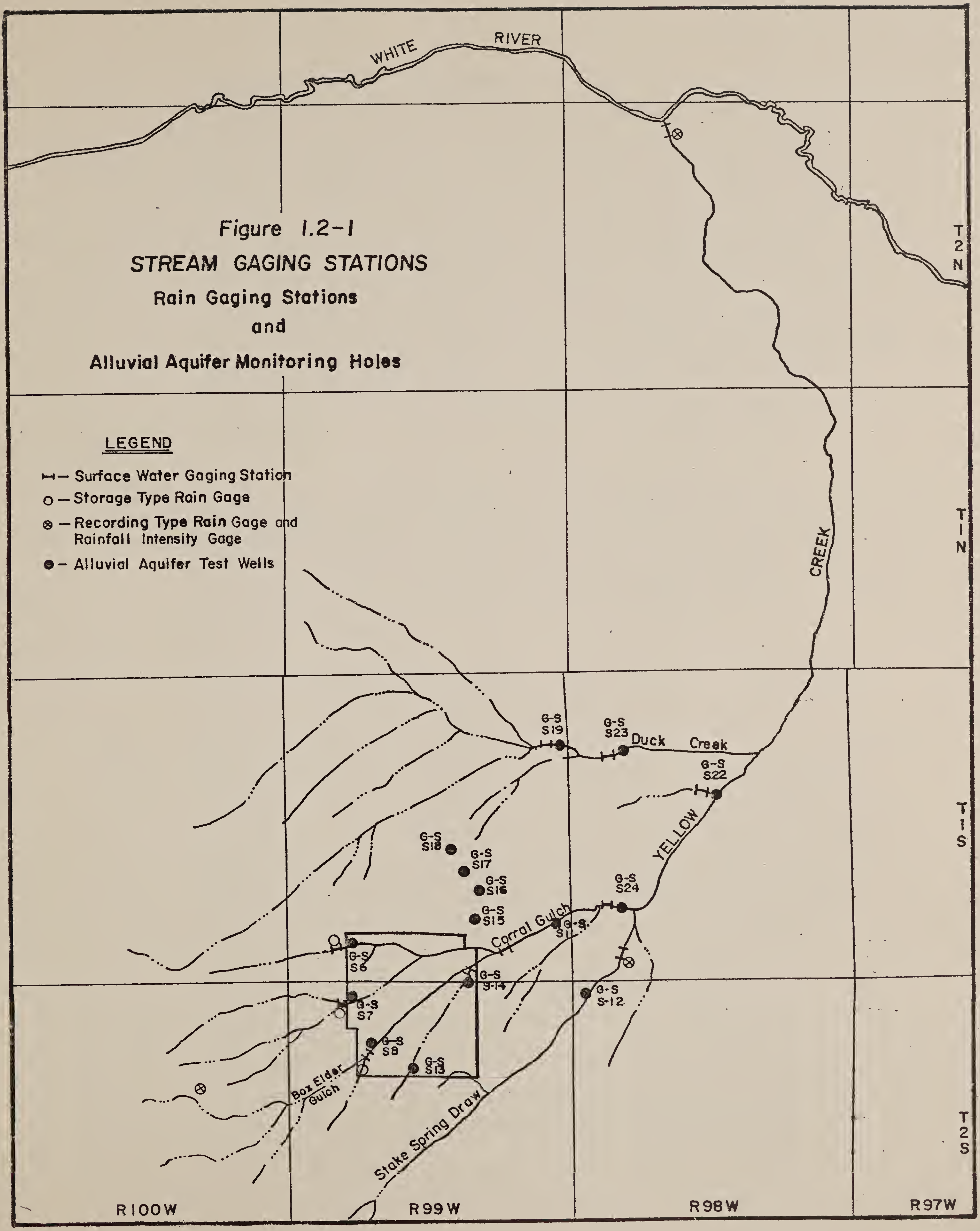


Figure 1.2-1
STREAM GAGING STATIONS
Rain Gaging Stations
and
Alluvial Aquifer Monitoring Holes

1.2.2 SURFACE WATER DATA COLLECTION

Previous surface hydrologic data submitted by the USGS were presented and discussed in RBOSP Progress Report 2, 3 and 4. Updated surface water data for the water year 1975 have been received. These data include continuous stream flow, temperature and conductivity of the gaging stations located at Corral Gulch east and near the west line of Tract C-a, Box Elder Gulch near the west line of Tract C-a, and Yellow Creek near White River. Continuous hydrologic data are used to replace the previous semi-monthly instantaneous data. The continuous plots of mean discharge, temperature and specific conductance are presented for the first time.

In addition, a limited amount of water quality data from two of the four gaging stations associated with 84 Mesa were also received from the USGS. However, the data from Lower Big Duck Creek north of 84 Mesa Station were incomplete and will not be included in the following discussion.

Flows during the water year 1975 were recorded at the following stations: Box Elder Gulch near west line of Tract C-a, Corral Gulch near west line of Tract C-a, Corral Gulch east of Tract C-a, Corral Gulch south of 84 Mesa, Yellow Creek near White River, Colorado. Flows were not recorded at Dry Fork near west line of Tract C-a, "Rinky Dink" Gulch near east line Tract C-a, Stake Springs Draw near confluence with Corral Gulch, Upper Big Duck Creek north of 84 Mesa, and Tributary to Yellow Creek east of 84 Mesa.

The streamflow recorder at Box Elder Gulch near the west line of Tract C-a was installed on March 13, 1974. Flow was not recorded until late April, 1974. Streamflow from late April through May 20 fluctuated between 2.3 to 2.6 cfs and then rapidly declined to no flow by June 10, 1974 and remained dry through the water year of 1974.

During the water year 1975, flow was not recorded at the station until April 30, 1975. The flow peaked in early June at 2.9 cfs and ceased by July 3. Two other short periods of flows were recorded in mid-July and August resulting from precipitation runoff.

Collection of streamflow data at Corral Gulch station near the west line of Tract C-a started in early March, 1974. Mean discharge gradually increased from 0.1 cfs in March to a maximum of 0.75 cfs in mid-May. Then the flow declined to 0.2 cfs by July 18, 1974, and fluctuated between 0.2 and 0.3 cfs through mid-November. Streamflow decreased to almost zero in early December, 1974. Flow increased again in late May, 1975, peaking in June at 0.64 cfs and then declining to 0.1 cfs in mid-July. It then increased again leveling out at 0.44 cfs through August. The flow had declined to 0.2 cfs by the end of September, 1975.

Streamflow recorder at Corral Gulch station east of the tract was installed on March 14, 1974 and streamflow was immediately monitored. A major increase in flows started in late April, 1974. By May 15, the stream had reached its maximum discharge of 2.1 cfs. The flow then rapidly dropped to 1.0 cfs within a few days and remained stable through late July, 1974. Streamflow gradually decreased to 0.3 cfs by mid-August.

The mean discharge from September 1974 through March 1975 was generally between 0.4 cfs and 0.6 cfs. In early April 1975 there was an increase in discharge due to the G-S D19 pumping test. The increased flow in May and June is due to both the combined G-S D18 and G-S D19 pumping test and intensified natural flow of Box Elder Gulch. By late September, the flow had decreased to approximately 0.6 cfs.

The instantaneous discharge data for the station at Corral Gulch south of 84 Mesa indicates that flow decreased from June through September of 1975 with a maximum of 0.81 cfs and a minimum of 0.29 cfs.

The gaging station at Yellow Creek near White River has been in operation since October 1, 1972. During the water year 1974, mean discharge gradually increased from October 1973 through March 1974, and then decreased from 3.0 cfs in April to about 1.5 cfs in September. Two instantaneous peak flows occurred in mid-March and July, 1974. During the water year 1975, stream discharge at Yellow Creek near White River achieved a mean peak flow of 3.0 cfs in March with a minimum of 0.7 cfs in late August through September 1975. Large increases in discharge occurring over the same period, lasting for only a few days, were due to precipitation events. Plots of mean discharge are shown in Figure 1.2-2 through 1.2-10.

Conductivity for Box Elder Gulch station near the west line of Tract C-a was recorded in May and June, 1975. During this period flow, specific conductance ranged from 957 umhos/cm to 270 umhos/cm, with an average value of 825 umhos/cm. On July 9, mean conductivity increased to 1230 umhos/cm due to intensified precipitation runoff.

For the Corral Gulch station near west line of Tract C-a, continuous conductivity data are available only from March through late April and from August through September of the 1975 water year. The maximum and minimum values for spring were 1253 umhos/cm and 953 umhos/cm, respectively. The approximate mean for this period was 1075 umhos/cm. During the summer the maximum conductivity was 1671 umhos/cm and a minimum of 780 umhos/cm. The daily mean conductivity increased from approximately 800 umhos/cm in mid-August to 1640 umhos/cm in mid-September, then declining to 1040 umhos/cm by the end of the month.

During the water year 1975, mean conductivity for the Corral Gulch station east of Tract C-a ranged from 1200 to 1300 umhos/cm. The first significant increase in specific conductance from 1200 to 1800 umhos/cm in early April was the result of the G-S D19 pumping test. The second increase from approximately 1250 to 2000 umhos/cm on May 22, 1975 is probably due to the discharge from both G-S D19 and G-S D18 pump tests.

At the Corral Gulch south of 84 Mesa station, the conductivity ranged from 1780 umhos/cm to 2000 umhos/cm from June through early September and a reading of 980 umhos/cm was measured in late September, 1975. No trend is evident due to limited data.

The conductivity at the Yellow Creek station near the White River reached a maximum of 4290 umhos/cm and a minimum of 897 umhos/cm with a mean of 3070 umhos/cm for the summer of 1974. In January 1975, a maximum of 4390 umhos/cm and a minimum of 1550 umhos/cm were recorded. The spring maximum and minimum were 5190 umhos/cm and 1120 umhos/cm respectively. The summer maximum was 5900 umhos/cm and the minimum was 2950 umhos/cm. There was considerable fluctuation in conductivity from day to day. The general trend was stable at about 3250 umhos/cm until the end of April, then increasing into 4000 umhos/cm by mid-July. Since continuous conductivity at the Yellow Creek Station near White River was only recorded in January, April, June through early July, a supplementary data plot of its instantaneous conductivity is therefore included in the interpretation. Mean conductivity plots are shown in Figure 1.2-11 through 1.2-16. Figure 1.2-16a is the instantaneous conductivity plot of Yellow Creek near White River.

Temperatures of the water at the Box Elder Gulch near west line of Tract C-a station ranged from a maximum of 31.4°C to a minimum of 1.9°C during May and June, 1975. The trend is increasing during this time.

The Corral Gulch station near the west line of Tract C-a recorded a maximum winter stream temperature of 6.2°C and a minimun of 0°C. The maximum spring temperature was 39.4°C and the minimum was 10.4°C. The maximum summer temperature was 40.0°C and the minimum was 1.8°C. Due to the limited data available, no trend is evident.

The Corral Gulch station east of Tract C-a recorded a maximum of 12.5°C and a minimum of 1.5°C during the winter; a maximum of 24.4°C and a minimum of 3.3°C during the spring; and a maximum of 18.5°C and a minimum of 7.1°C during the summer. The mean temperature from January through April, 1975, ranged from 7°C to 9°C. Then, it increased steadily to its maximum temperature of 15°C in late May. By June 1, 1975 the mean temperature had dropped and fluctuated at 12°C through the end of the water year.

The Yellow Creek station recorded a maximum of 34.0°C and a minimum of 5.0°C during the summer of 1974. The winter temperatures ranged from a maximum of 11.3°C to a minimum of 0°C. The spring temperatures ranged from a maximum of 30.5°C to a minimum of 0°C. The maximum July temperature was 45°C and the minimum was 19.9°C. In general, the mean temperature started rising in early April and continued to increase into the summer. Daily mean temperature plots are shown in Figure 1.2-17 through 1.2-21.

Sediment concentration and discharge at the Box Elder Gulch station near the west line of Tract C-a reached a maximum of 2940 mg/l and 21 tons/day (TPD) respectively in late May when maximum flow occurred. Only instantaneous sediment data was available for Corral Gulch near west line of Tract C-a. The USGS reports that the flow was too low for the automatic samples to pick up any continuous measurements. Both sediment concentration and discharge show strong increases in early June when streamflows were intensified by snowmelt runoff. The maximum daily sediment concentration and discharge were 2840 mg/l and 4.37 TPD respectively for the 1975 water year.

At the Corral Gulch station east of Tract C-a changes in both sediment concentration and discharge are associated with increases in streamflow. A maximum sediment concentration of 5500 mg/l occurred on March 1, 1975. However, a maximum sediment discharge of 56 TPD was recorded on May 24, 1975, at which time the sediment concentration was 4130 mg/l.

The sediment concentration and discharge at the Yellow Creek station near White River show substantial increases in March and April. Other increases in discharge of shorter duration occurred during the summer. Maximum sediment concentration and discharge for the 1975 water year were 8,510 mg/l and 62 TPD recorded on March 4, 1975. These concentration and discharge values were associated with high streamflow. Daily sediment concentration and discharge for water years 1974 and 1975 are shown in Figures 1.2-22 through 1.2-33.

Boron concentrations in Box Elder Gulch near the west line of Tract C-a decreased from 1.0 mg/l in May to 0.7 mg/l in late June, 1975. No new data were obtained since then. At the Corral Gulch station near the west line of Tract C-a, boron values have been constant at approximately 0.1 mg/l from January through September, 1975. At the Corral Gulch Station east of the Tract, boron fluctuated from 0.2 mg/l to 0.7 mg/l in April and May with a fairly stable trend at 0.16 mg/l from mid-June through late September, 1975. Boron concentration at Corral Gulch south of 84 Mesa was approximately 0.2 mg/l in June, July, and September. At Yellow Creek near White River station, boron, concentration varied from 0.6 mg/l in January to 0.7 mg/l in October, 1975.

Fluoride concentrations at Box Elder Gulch Station near the west line of Tract C-a were approximately 0.3 mg/l from May through June, 1975. No new values were reported from the U.S.G.S. Fluoride in Corral Gulch near the west line of the Tract decreased from 0.3 mg/l in January to 0.2 mg/l in May, then had been stable at 0.3 mg/l from late May through September 1975. At the Corral Gulch station east of the Tract, fluoride values have fluctuated between 0.4 and 0.6 mg/l from January to late September, 1975. Two significant increases in concentration occurred in mid-April and late May. They were associated with the discharges from the G-S D18 and G-S D19 pumping tests. Fluoride was approximately 0.3 mg/l during June through July and in September, 1975 at Corral Gulch station south of 84 Mesa. At Yellow Creek station near White River, fluoride values ranged from a minimum of 1.8 mg/l in mid-April to a maximum of 2.4 mg/l in late August, 1975. Boron and fluoride concentrations are shown in Figures 1.2-34 through 1.2-38.

Tables 1.2-3 through 1.2-7 are summary water analysis for the stream gaging stations.

There are three types of precipitation gages used for collecting data in RBOSP. The storage precipitation gages allows precipitation to be collected and measured periodically. This type of gage also gives information as to how much precipitation has fallen during this period. The second type of precipitation gage is the recording type gage which allows the measurement of precipitations on a daily basis. The third type is the rainfall-intensity gage which records the time of each rainfall event and measures precipitation depth with a time increment of 5 minutes.

Information from the storage precipitation gages indicate an increase during August, October and November. The cumulative rainfall over most of August was 0.9 inches. The first eight days in September averaged 0.17 inches of moisture at each of the three stations. The next twenty-three days averaged 0.27 inches. A strong increase then occurred from October 2 through November 27 with cumulative precipitation averaging 2.0 inches. Total precipitation from August through November for Dry Fork, Box Elder Gulch and Corral Gulch stations near the west line of Tract C-a were 3.1, 2.8 and 3.9 inches, respectively. Prior to August, Dry Fork and Corral Gulch stations near the west line of Tract C-a had peak amounts in May, while the station at Box Elder Gulch near the west line of Tract C-a reached a maximum between March and April. This indicates localized rain showers. A dry period from June 23 through July 12, 1975 was reported in Report 4. During this time, no rainfall was recorded at Dry Fork and Box Elder Gulch stations near the west line of Tract C-a. Below average rainfall was measured at Corral Gulch near west line of the tract. However, review of USGS precipitation data indicates that these data were effected by evaporations. Therefore, the precipitations measured during this period were not thought to be representative. Figures 1.2-39 through 1.2-41 are plots of storage type precipitations.

Recording rain gages indicate that during the period from August through October, widespread precipitation occurred on October 21 and 22 which averaged 0.69 inches. October 30 and November 9 through 10 also show rainfall correlations between the three stations. These moisture falls average 0.34 inches and 0.10 inches respectively. Other precipitation fall over August through November are not correlatable between all three stations indicating localized rain and snow showers. Average monthly precipitation values for August through November at Cathedral Bluffs, Stake

Springs Draw near the confluence with Corral Gulch, and Yellow Creek near White River are 1.32 inches, 0.54 inches and 0.68 inches respectively. Cumulative totals over this same period for these stations are 5.26 inches, 2.16 inches, and 2.75 inches.

The rain-gaging station near Cathedral Bluffs reported equipment malfunction in June and July, 1975. Recording type precipitation data were not taken during that period. However, the data from the rainfall-intensity gage were received from the USGS. Per their advice, the rainfall-intensity data were used to complete the recording type precipitation plots for June and July, 1975.

Figure 1.2-42 through 1.2-47 are plots of recording type precipitation.

Table 1.2-8 is the summary of the total precipitation for each of the rain-gaging stations associated with Tract C-a.

TABLE 1.2-3

SUMMARY WATER ANALYSIS

STREAM GAGING STATION, USGS 09306240

BOX ELDER GULCH NEAR WEST LINE TRACT C-a

	5/14/75	5/28/75	6/16/75	6/25/75
1. Alkalinity (mg/l)	257	290	267	274
2. Aluminum (ug/l)				
3. Ammonia (mg/l)	.01	.00	.00	.00
4. Aromatics, Polycyclic				
5. Arsenic (ug/l)	8	5	5	3
6. Barium (ug/l)	100	0	100	0
7. Beryllium (ug/l)				
8. Bicarbonate (mg/l)	313	354	326	334
9. Bismuth (ug/l)				
10. Boron (ug/l)	100	110	80	70
11. Cadmium (ug/l)	0	0	0	0
12. Carbonate (mg/l)	0	0	0	0
13. Carbon Dioxide (mg/l)	1.6	---	.5	.8
14. Chloride (mg/l)	6.0	5.2	5.2	6.0
15. Chromium (ug/l)	20	0	0	0
16. Cobalt (ug/l)				
17. COD				
18. Coliform, Total & Fecal				
19. Color (PVC)	9	2	17	9
20. Conductivity, Specific	845	880	800	800
21. Copper (ug/l)	3	6	2	1
22. Cyanide (mg/l)	.01	.00	.00	.01
23. Discharge (CFS)				
24. Discharge, Instantaneous	.55	---	---	.49
25. Dissolved Oxygen (mg/l)	5.5	8.8	8.3	8.0
26. Fluoride (mg/l)	.3	.4	.3	.3
27. Gallium (ug/l)				
28. Germanium (ug/l)				
29. Hardness (Ca, Mg) (mg/l)	340	380	350	340
30. Hardness, Non-Carbonate (mg/l)	79	86	81	67
31. Iron (ug/l)	20	40	10	0
32. Kjeldahl Nitrogen (mg/l)	.37	2.7	.66	.31
33. Lead (ug/l)	2	3	1	1
34. Lithium (ug/l)	20	10	20	20
35. Magnesium (mg/l)	49	46	47	44
36. Manganese (ug/l)	5	20	0	5
37. Mercury (ug/l)	.0	.0	.0	.0
38. Molybdenum (ug/l)				
39. Nickel (ug/l)				
40. Nitrate (mg/l)	4.1	4.4	4.1	3.9
41. Nitrite (mg/l)	.00	.00	.03	.03
42. Nitrite Plus Nitrate (mg/l)	.92	1.0	.93	.89
43. Nitrogen, Ammonia	.01	.00	.00	.00
44. Odor (Severity)	0	0	0	0
45. Oil & Grease (mg/l)	2	1	E2	3
46. Ortho-Phosphate (mg/l)	.06	.09	.03	.03
47. Ortho-Phosphorus (mg/l)	.02	.03	.01	.01
48. Pesticides				
49. pH	8.5	---	9.0	8.8
50. Phosphorus, Total (mg/l)	.12	.41	.03	.03
51. Potassium (mg/l)	1.5	1.0	.7	.7
52. Selenium (ug/l)	3	5	4	5
53. Silica (mg/l)	23	21	22	23
54. Silver (ug/l)				
55. Sodium (mg/l)	56	49	39	55
56. Sodium Adsorption Ratio	1.3	1.1	.9	1.3
57. Sodium (%)	27	22	20	26
58. Solids, Dissolved (mg/l)	520	527	482	521
59. Solids, Dissolved T/D	.77	---	---	.69
60. Solids, Dissolved T/Ac-Ft	.71	.72	.66	.71
61. Solids, Suspended				
62. Strontium (ug/l)				
63. Sulfate (mg/l)	170	150	140	160
64. Sulfide (mg/l)	.0	.2	.2	.0
65. Temperature (°C)	27.5	8.5	19.0	12.5
66. Tin (ug/l)				
67. Titanium (ug/l)				
68. Turbidity JTU)	50	210	32	13
69. Vanadium (ug/l)				
70. Zinc (ug/l)	0	10	10	0
71. Zirconium (ug/l)				
72. Calcium (mg/l)				
73. Complete Element Span				
74. Radioactivity				
Gross Alpha (pci)				
Radium 226*				
Gross Beta				
Thorium 230**				
Uranium**				
75. Total Organic Carbon (mg/l)				
If TOC >10 mg/liter, then				
Nitrogen (Base Extraction)				
Organic Carbon, Dissolved				
Organic Carbon, Suspended				
Phenols				
Sulfur (Acid Extraction)				
76. Total Ortho-Phosphorous (mg/l)	.03	.04	.01	.01
77. Phosphate	.37	1.3	.09	.09

TABLE 1.2-4

SUMMARY WATER ANALYSIS

STREAM GAGING STATION, USGS 0930235

CORRAL GULCH NEAR WEST LINE TRACT C-a

	3/12/75	3/16/75	4/9/75	4/23/75	5/14/75	5/28/75	6/11/75	6/24/75	7/15/75	7/30/75	8/12/75	8/26/75
1. Alkalinity (mg/l)			324	301	291	322	318	305	312	315	349	335
2. Aluminum (ug/l)			---	---	---	---	---	---	---			
3. Ammonia (mg/l)			.12	.00	.04	.00	.00	.05	.04	,00	.00	.00
4. Aromatics, Polycyclic			---		---							
5. Arsenic (ug/l)			4	5	4	9	4	4	4	4	4	4
6. Barium (ug/l)			<100	0	100	0	100	0	200	0	100	<200
7. Beryllium (ug/l)			---		---							
8. Bicarbonate (mg/l)			395	367	355	393	388	372	380	384	425	408
9. Bismuth (ug/l)			---		---							
10. Boron (ug/l)			90	100	90	90	90	100	80	110	90	100
11. Cadmium (ug/l)			0	1	0	0	0	0	0	1	0	0
12. Carbonate (mg/l)			0	0	0	0	0	0	0	0	0	0
13. Carbon Dioxide (mg/l)			2.0	2.3	11	32	4.9	1.2	2.4	3.1	2.2	5.2
14. Chloride (mg/l)			7.8	9.2	8.9	6.8	5.9	7.0	8.3	6.9	8.2	7.6
15. Chromium (ug/l)			0	0	0	0	0	0	0	0	0	10
16. Cobalt (ug/l)												
17. COO												
18. Coliform, Total & Fecal												
19. Color (PVC)			9	3	10	7	3	8	15			
20. Conductivity, Specific			1080	1100	1100	900	1050	1100	1200	1125	925	1150
21. Copper (ug/l)			8	3	2	1	-	4	0	2	4	1
22. Cyanide (mg/l)			.00	.01	.01	.00	.00	.01	.00	.00	.00	.00
23. Oischarge (CFS)												
24. Oischarge, Instantaneous			.04	.03	.02	.10	---	.18	.10	.24	.47	.49
25. Oissolved Oxygen (mg/l)			---	7.0	8.7	9.1	5.6	6.4	7.0	9.2	---	---
26. Fluoride (mg/l)			.2	.2	.2	.2	.3	.3	.3	.3	.2	.3
27. Gallium (ug/l)												
28. Germanium (ug/l)												
29. Hardness (Ca, Mg) (mg/l)			460	430	420	460	560	450	460	480	460	470
30. Hardness, Non-Carbonate (mg/l)			140	130	130	140	140	140	150	160	110	130
31. Iron (ug/l)			50	20	20	60	30	10	30	10	20	50
32. Kjeldahl Nitrogen (mg/l)			4.2	.36	.30	1.0	.89	.25	.65	1.0	.47	.52
33. Lead (ug/l)			0	3	1	2	0	2	0	0	1	0
34. Lithium (ug/l)			20	10	20	20	10	20	10	20	20	20
35. Magnesium (mg/l)			60	59	56	58	61	60	60	66	58	60
36. Manganese (ug/l)			0	0	0	20	0	0	0	10	0	10
37. Mercury (ug/l)			1.0	.0	.00	.0	.0	.0	.0	.0	.0	.0
38. Molybdenum (ug/l)			---		---							
39. Nickel (ug/l)			---		---							
40. Nitrate (mg/l)			4.3	2.8	2.2	4.4	6.6	5.3	4.0	3.7	3.6	4.0
41. Nitrite (mg/l)			.00	.03	.00	.00	.03	.00	.03	.03	.03	.03
42. Nitrite Plus Nitrate (mg/l)			.98	.64	.50	1.0	1.5	1.2	.91	.85	.83	.92
43. Nitrogen, Ammonia			.09		.03					.00	.00	.00
44. Odor (Severity)			1	0	0	0	0	0	0	0	---	---
45. Oil & Grease (mg/l)			3	---	0	2	1	3	4	1	1	0
46. Ortho-Phosphate (mg/l)			.06	.06	.06	.06	.00	.03	.06			
47. Ortho-Phosphorus (mg/l)			.02	.02	.02	.02	.00	.01	.02	.01	.00	.00
48. Pesticides												
49. pH			8.5	8.4	7.7	7.3	3.1	8.7	8.4	8.3	8.5	8.1
50. Phosphorus, Total (mg/l)			1.3	.06	.03	.07	.20	.01	.03	.06	.07	.02
51. Potassium (mg/l)			1.6	1.5	1.5	1.4	1.1	1.0	1.5	1.5	1.6	1.3
52. Selenium (ug/l)			4	4	4	5	3	5	4	4	5	3
53. Silica (mg/l)			19	20	18	19	23	22	21	23	22	22
54. Silver (ug/l)			---		---							
55. Sodium (mg/l)			86	90	91	75	49	80	87	87	84	86
56. Sodium Adsorption Ratio			1.7	1.9	1.9	1.5	1.0	1.6	1.8	1.7	1.7	1.7
57. Sodium (%)			29	31	32	26	19	28	29	28	29	28
58. Solids, Dissolved (mg/l)			729	719	719	709	563	699	734	760	755	752
59. Solids, Dissolved T/O			.08	.06	.04	.19	---	.34	.20	.49	.96	.99
60. Solids, Oissolved T/Ac-Ft			.99	.98	.98	.96	.90	.95	1.00	1.03	1.03	1.02
61. Solids, Suspended												
62. Strontium (ug/l)			---		---							
63. Sulfate (mg/l)			2.70	280	2.90	260	240	260	280	300	280	280
64. Sulfide (mg/l)			.2	.0	.0	.0	.1	.0	.0	.0	.2	.2
65. Temoerature (°C)			2.0	21.0	20.0	9.0	13.0	18.0	22.0	26.5	21.0	22.5
66. Tin (ug/l)			---		---							
67. Titanium (ug/l)			---		---							
68. Turbidity (JTU)			450	15	18	75	120	13	17	34	36	33
69. Vanadium (ug/l)			---		---							
70. Zinc (ug/l)			20	0	10	0	10	6	0	20	10	10
71. Zirconium (ug/l)			---		---							
72. Calcium (mg/l)			85		76					82	87	89
73. Complete Element Span												
74. Radioactivity												
Gross Alpha (pci)												
Radium 226*												
Gross Beta												
Thorium 230**												
Uranium**												
75. Total Organic Carbon (mg/l)			---		---							
If TOC 10 mg/liter, then												
Nitrogen (Base Extraction)												
Organic Carbon, Oissolved												
Organic Carbon, Suspended												
Phenols												
Sulfur (Acid Extraction)												
76. Total Ortho-Phosphorous (mg/l)			.45	.01	.04	.01	.01	.02	.01	.02	.03	.00
77. Phosphate			---	.18	.09	.21	.61	.03	.09			

TABLE 1.2-4

(CONTINUED)

SUMMARY WATER ANALYSIS

STREAM GAGING STATION, USGS 0930235

CORRAL GULCH NEAR WEST LINE TRACT C-a

	9/8/75	9/24/75										
1. Alkalinity (mg/l)	341	334										
2. Aluminum (ug/l)	40											
3. Ammonia (mg/l)	.00	.01										
4. Aromatics, Polycyclic												
5. Arsenic (ug/l)	6	4										
6. Barium (ug/l)	<200	<200										
7. Beryllium (ug/l)	<1	<1										
8. Bicarbonate (mg/l)	416	407										
9. Bismuth (ug/l)	<5											
10. Boron (ug/l)	100	100										
11. Cadmium (ug/l)	2	0										
12. Carbonate (mg/l)	0	0										
13. Carbon Dioxide (mg/l)	4.2	3.3										
14. Chloride (mg/l)	7.5	7.3										
15. Chromium (ug/l)	0	10										
16. Cobalt (ug/l)	<3											
17. COD	16											
18. Coliform, Total & Fecal												
19. Color (PCU)												
20. Conductivity, Specific	1050	1100										
21. Copper (ug/l)	5	1										
22. Cyanide (mg/l)	.00	.00										
23. Discharge (CFS)												
24. Discharge, Instantaneous	.27	.44										
25. Dissolved Oxygen (mg/l)	9.0	9.8										
26. Fluoride (mg/l)	.3	.3										
27. Gallium (ug/l)	<3											
28. Germanium (ug/l)	<5											
29. Hardness (Ca, Mg) (mg/l)	470	480										
30. Hardness, Non-Carbonate (mg/l)	130	150										
31. Iron (ug/l)	0	40										
32. Kjeldahl Nitrogen (mg/l)	.43	.64										
33. Lead (ug/l)	4	1										
34. Lithium (ug/l)	20	20										
35. Magnesium (mg/l)	60	61										
36. Manganese (ug/l)	0	10										
37. Mercury (ug/l)	.0	.0										
38. Molybdenum (ug/l)	46											
39. Nickel (ug/l)	<5											
40. Nitrate (mg/l)	3.8	3.4										
41. Nitrite (mg/l)	.03	.03										
42. Nitrite Plus Nitrate (mg/l)	.86	.78										
43. Nitrogen, Ammonia	.00	.01										
44. Odor (Severity)	0	0										
45. Oil & Grease (mg/l)	1	0										
46. Ortho-Phosphate (mg/l)												
47. Ortho-Phosphorus (mg/l)	.00	.01										
48. Pesticides												
49. pH	8.2	8.3										
50. Phosphorus, Total (mg/l)	.07	.06										
51. Potassium (mg/l)	1.2	1.1										
52. Selenium (ug/l)	3	3										
53. Silica (mg/l)	21	21										
54. Silver (ug/l)	0											
55. Sodium (mg/l)	86	89										
56. Sodium Adsorption Ratio	1.7	1.8										
57. Sodium (%)	28	29										
58. Solids, Dissolved (mg/l)	756	767										
59. Solids, Dissolved T/D	.55	.91										
60. Solids, Dissolved T/Ac-Ft	1.03	1.04										
61. Solids, Suspended												
62. Strontium (ug/l)	1400											
63. Sulfate (mg/l)	280	290										
64. Sulfide (mg/l)	.3	.0										
65. Temperature (°C)	12.0	13.5										
66. Tin (ug/l)	<5											
67. Titanium (ug/l)	<3											
68. Turbidity (JTU)	2	20										
69. Vanadium (ug/l)	<3.0											
70. Zinc (ug/l)	10	10										
71. Zirconium (ug/l)												
72. Calcium (mg/l)	90	93										
73. Complete Element Span												
74. Radioactivity												
Gross Alpha (pci)	<8.9											
Radium 226*												
Gross Beta												
Thorium 230**												
Uranium**												
75. Total Organic Carbon (mg/l)	8.0											
If TOC 10 mg/liter, then												
Nitrogen (Base Extraction)												
Organic Carbon, Dissolved												
Organic Carbon, Suspended												
Phenols												
Sulfur (Acid Extraction)												
76. Total Ortho-Phosphorous (mg/l)	.01	.01										
77. Phosphate												
78. Phosphorus, Dissolved												

TABLE 1.2-5

SUMMARY WATER ANALYSIS

STREAM GAGING STATION, USGS 09306242

CORRAL GULCH EAST OF TRACT C-a

	Date	3/12/75	3/26/75	4/9/75	4/9/75	4/23/75	5/14/75	5/28/75	6/11/75	6/24/75	7/15/75	7/30/75	8/12/75
	Time	1100	1415	1045	1100	1100	1245	1430	1545	1450	1230	1110	1500
1.	Alkalinity (mg/l)	417	---	---	739	603	421	663	378	401	389	361	349
2.	Aluminum (ug/l)	20	---	---	---	---	---	---	---	---	---	---	
3.	Ammonia (mg/l)	.28	---	---	.35	.15	.03	.22	.00	.00	.04	.00	.00
4.	Aromatics, Polycyclic												
5.	Arsenic (ug/l)	6	---	---	7	2	5	9	4	3	5	6	6
6.	Barium (ug/l)	50	---	---	<100	0	0	100	100	0	100	0	100
7.	Beryllium (ug/l)	<2	---	---	---	---	---	---	---	---	---	---	
8.	Bicarbonate (mg/l)	508	---	---	901	735	513	315	461	489	474	464	426
9.	Bismuth (ug/l)	<5	---	---	---	---	---	---	---	---	---	---	
10.	Boron (ug/l)	100	---	---	320	550	160	670	150	160	140	120	140
11.	Cadmium (ug/l)	<60	---	---	0	1	1	0	0	0	0	3	0
12.	Carbonate (mg/l)	0	---	---	0	0	0	0	0	0	0	0	0
13.	Carbon Dioxide (mg/l)	13	---	---	7.2	7.4	65	13	7.4	4.9	4.8	.9	4.3
14.	Chloride (mg/l)	8.9	---	---	11	16	11	15	8.8	9.7	11	10	11
15.	Chromium (ug/l)	<5	---	---	0	0	0	0	0	0	0	0	10
16.	Cobalt (ug/l)	<5	---	---	---	---	---	---	---	---	---	---	
17.	COD	94	---	---	---	---	---	---					
18.	Coliform, Total & Fecal												
19.	Color (PVC)	8	---	---	5	0	5	6	17	19	6	6	
20.	Conductivity, Specific	1200	---	---	1725	1550	1300	1550	1100	1200	1000	1150	1200
21.	Copper (ug/l)	2	---	---	3	6	1	1	0	1	0	4	3
22.	Cyanide (mg/l)	.00	---	---	.00	.01	.01	.02	.02	.01	.00	.00	.00
23.	Discharge (CFS)												
24.	Discharge, Instantaneous	.34	---	---	1.1	1.3	.46	3.1	---	1.5	1.1	1.0	.62
25.	Dissolved Oxygen (mg/l)	9.0	---	5.4	5.4	7.3	2.0	3.1	5.0	4.8	6.7	7.6	
26.	Fluoride (mg/l)	.4	---	---	10	4.3	.4	2.8	.5	.5	.5	.6	.4
27.	Gallium (ug/l)	<2	---	---	---	---	---	---	---	---	---	---	
28.	Germanium (ug/l)	<6	---	---	---	---	---	---	---	---	---	---	
29.	Hardness (Ca, Mg) (mg/l)	520	---	---	360	380	430	390	420	410	430	460	430
30.	Hardness, Non-Carbonate (mg/l)	98	---	---	0	0	53	0	42	6	37	75	83
31.	Iron (ug/l)	120	---	---	30	10	30	[illegible]	70	0	20	10	20
32.	Kjeldahl Nitrogen (mg/l)	.67	---	---	2.4	1.1	.14	2.2	.67	.30	.52	.30	.19
33.	Lead (ug/l)	<5	---	---	2	6	1	1	0	1	0	3	0
34.	Lithium (ug/l)	14	---	---	30	20	10	20	10	10	0	10	10
35.	Magnesium (mg/l)	70	---	---	52	59	53	53	56	54	55	64	57
36.	Manganese (ug/l)	43	---	---	0	70	20	6	0	5	0	0	10
37.	Mercury (ug/l)	.0	---	---	.3	0	0	0	.0	.0	.0	.0	.0
38.	Molybdenum (ug/l)	30	---	---	---	---	---	---	---	---	---	---	
39.	Nickel (ug/l)	<4	---	---	---	---	---	---	---	---	---	---	
40.	Nitrate (mg/l)	1.2	---	---	1.2	1.5	1.4	3.0	3.0	2.5	1.6	1.5	1.3
41.	Nitrite (mg/l)	.07	---	---	.00	.10	.00	.03	0.3	.03	.03	.03	.03
42.	Nitrite Plus Nitrate (mg/l)	.28	---	---	.28	.36	.32	.68	.69	.57	.37	.34	.30
43.	Nitrogen, Ammonia	.22	---	---	.27	.12	.02	.17	.00	.00	.03	.00	.00
44.	Odor (Severity)	3	2	2	---	0	0	1	0	0	0	1	
45.	Oil & Grease (mg/l)	4	---	---	2	3	0	2	2	3	2	1	1
46.	Ortho-Phosphate (mg/l)	.28	---	---	.06	.12	.15	[illegible]	.00	.06	.15	.03	
47.	Ortho-Phosphorus (mg/l)	.09	---	---	.02	.04	.05	.04	.00	[illegible]	.05	.01	.02
48.	Pesticides												
49.	pH	7.8	---	---	8.3	8.2	8.1	8.0	8.0	8.2	8.2	8.9	8.2
50.	Phosphorus, Total (mg/l)	.37	---	---	.60	.56	.25	.41	.54	.07	.04	.04	.04
51.	Potassium (mg/l)	1.4	---	---	2.3	2.0	1.8	2.2	1.4	1.4	1.4	1.6	1.4
52.	Selenium (ug/l)	2	---	---	2	1	2	[illegible]	3	4	3	3	4
53.	Silica (mg/l)	13	---	---	19	19	21	20	23	21	21	22	22
54.	Silver (ug/l)	0	---	---	---	---	---	---	---	---	---	---	
55.	Sodium (mg/l)	110	---	---	300	240	120	250	34	110	110	110	120
56.	Sodium Adsorption Ratio	2.1	---	---	6.8	5.4	2.4	5.5	2.0	2.4	2.2	[illegible]	2.5
57.	Sodium ( )	32	---	---	64	58	35	58	33	37	36	[illegible]	38
58.	Solids, Dissolved (mg/l)	838	---	---	1140	1040	[illegible]	1020	691	724	775	[illegible]	793
59.	Solids, Dissolved T/D	.77	---	---	3.57	3.73	[illegible]	2.54	---	2.97	2.34	[illegible]	1.33
60.	Solids, Dissolved T/Ac-Ft	1.14	---	---	1.55	1.41	[illegible]	1.39	.94	.98	1.05	1.06	1.08
61.	Solids, Suspended												
62.	Strontium (ug/l)	1600	---	---	---	---	---	---	---	---	---	---	
63.	Sulfate (mg/l)	290	---	---	240	280	290	200	200	210	260	260	290
64.	Sulfide (mg/l)	.0	---	---	.3	.0	.2	[illegible]	.2	.0	[illegible]	0	.2
65.	Temperature (°C)	8.0	---	---	7.0	13.0	14.0	11.0	19.0	15.0	15.0	17.0	13.0
66.	Tin (ug/l)	<5	---	--	---	---	---	--	---	---	---	---	
67.	Titanium (ug/l)	<[illegible]	---	---	---	---	---	---					
68.	Turbidity (JTU)	1000	---	---	740	50	[illegible]	[illegible]	150	50	13	4	2
69.	Vanadium (ug/l)	3.0	---	---	--	---	---		---	---	---	---	
70.	Zinc (ug/l)	0	---	---	40	10	6	[illegible]	10	4	0	20	0
71.	Zirconium (ug/l)	<9	---	---	---	---	---	---					
72.	Calcium (mg/l)	90	---	---	60	55	[illegible]	63					77
73.	Complete Element Span												
74.	Radioactivity												
	Gross Alpha (pci)	<10	---	---	---	---	---	---					
	Radium 226*												
	Gross Beta	<2.4	---	---	---	---	---	---					
	Thorium 230**												
	Uranium**												
75.	Total Organic Carbon (mg/l)	9.8	---	---	---	--	---	---					
	If TOC >10 mg/liter, then												
	Nitrogen (Base Extraction)												
	Organic Carbon, Dissolved												
	Organic Carbon, Suspended												
	Phenols												
	Sulfur (Acid Extraction)												
76.	[illegible] Ortho-Phosphorous	.11	---	---	.53	[illegible]	[illegible]	[illegible]	[illegible]	.03	[illegible]	[illegible]	.04
77.	Phosphate	--	--	---	--	[illegible]	.15	[illegible]	[illegible]	.21	[illegible]	[illegible]	

TABLE 1.2-5
(CONTINUED)
SUMMARY WATER ANALYSIS
STREAM GAGING STATION, USGS 09306242
CORRAL GULCH EAST OF TRACT C-a

	5/27/75 1130	9/8/75 1430	4/2[illegible]/75 1225
1. Alkalinity (mg/l)	413	406	420
2. Aluminum (ug/l)		30	
3. Ammonia (mg/l)	.00	.00	.03
4. Aromatics, Polycyclic			
5. Arsenic (ug/l)	4	7	6
6. Barium (ug/l)	<200	<200	<200
7. Beryllium (ug/l)		<2	
8. Bicarbonate (mg/l)	503	495	512
9. Bismuth (ug/l)		<6	
10. Boron (ug/l)	150	150	160
11. Cadmium (ug/l)	0	0	0
12. Carbonate (mg/l)	0	0	0
13. Carbon Dioxide (mg/l)	16	13	21
14. Chloride (mg/l)	9.7	11	10
15. Chromium (ug/l)	50	0	10
16. Cobalt (ug/l)		<3	
17. COD			
18. Coliform, Total & Fecal			
19. Color (PCU)			
20. Conductivity, Specific	1100	1200	1300
21. Copper (ug/l)	1	2	1
22. Cyanide (mg/l)	.00	.00	.00
23. Discharge (CFS)			
24. Discharge, Instantaneous	.66	.57	.34
25. Dissolved Oxygen (mg/l)	---	9.0	10.3
26. Fluoride (mg/l)	.5	.5	.5
27. Gallium (ug/l)		<3	
28. Germanium (ug/l)		<6	
29. Hardness (Ca, Mg) (mg/l)	490	470	490
30. Hardness, Non-Carbonate (mg/l)	73	64	74
31. Iron (ug/l)	10	50	10
32. Kjeldahl Nitrogen (mg/l)	.30	.25	.48
33. Lead (ug/l)	0	2	3
34. Lithium (ug/l)	10	10	10
35. Magnesium (mg/l)	67	65	66
36. Manganese (ug/l)	10	10	20
37. Mercury (ug/l)	.0	.0	.0
38. Molybdenum (ug/l)		56	
39. Nickel (ug/l)		<6	
40. Nitrate (mg/l)	1.2	1.2	1.2
41. Nitrite (mg/l)	.03	.03	.03
42. Nitrite Plus Nitrate (mg/l)	.29	.27	.29
43. Nitrogen, Ammonia	.00	.00	.03
44. Odor (Severity)		0	0
45. Oil & Grease (mg/l)	1	1	2
46. Ortho-Phosphate (mg/l)			
47. Ortho-Phosphorus (mg/l)	.02	.02	.03
48. Pesticides			
49. pH	7.7	7.8	7.6
50. Phosphorus, Total (mg/l)	.00	.04	.07
51. Potassium (mg/l)	1.7	1.5	1.3
52. Selenium (ug/l)	1	2	3
53. Silica (mg/l)	21	21	21
54. Silver (ug/l)		0	
55. Sodium (mg/l)	120	120	120
56. Sodium Adsorption Ratio	2.4	2.4	2.4
57. Sodium ( )	35	36	35
58. Solids, Dissolved (mg/l)	834	836	852
59. Solids, Dissolved T/D	1.49	1.29	.78
60. Solids, Dissolved T/Ac-Ft	1.13	1.14	1.16
61. Solids, Suspended			
62. Strontium (ug/l)		1400	
63. Sulfate (mg/l)	280	290	290
64. Sulfide (mg/l)	.0	.2	.0
65. Temperature (°C)	15.5	11.0	12.0
66. Tin (ug/l)		<6	
67. Titanium (ug/l)		<3	
68. Turbidity (JTU)	2	0	2
69. Vanadium (ug/l)		4.0	
70. Zinc (ug/l)	0	0	10
71. Zirconium (ug/l)			
72. Calcium (mg/l)	84	81	89
73. Complete Element Span			
74. Radioactivity			
Gross Alpha (pCi/l)		<6.7	
Radium 226*			
Gross Beta		9.4	
Thorium 230**			
Uranium**			
75. Total Organic Carbon (mg/l)			
[illegible] Ether, Phen			
Nitrogen (Base Extraction)			
Organic Carbon, Dissolved			
Organic Carbon, Suspended			
Phenols			
Sulfur (Acid Extraction)			
Total [illegible]-Phos[illegible]	.02	.04	.03
Phosphate			
Phosphorus, Dissolved			

TABLE 1.2-6

SUMMARY WATER ANALYSIS

STREAM GAGING STATION, USGS 09306244

CORRAL GULCH SOUTH OF 84 MESA

	6/12/75 1300	6/25/75 1300	7/15/75 1330	7/30/75 1430	9/9/75 0930	[illegible]/24/75 1345						
1. Alkalinity (mg/l)	532	477	523	525	540	479						
2. Aluminum (ug/l)	50				20							
3. Ammonia (mg/l)	.01	.00	.00	.05	.00	.06						
4. Aromatics, Polycyclic												
5. Arsenic (ug/l)	3	3	5	6	7	4						
6. Barium (ug/l)	0	0	200	0	<200	100						
7. Beryllium (ug/l)	<4				<2							
8. Bicarbonate (mg/l)	649	582	638	640	658	534						
9. Bismuth (ug/l)	<9				<9							
10. Boron (ug/l)	190	160	190	150	210	190						
11. Cadmium (ug/l)	0	0	1	1	0	1						
12. Carbonate (mg/l)	0	0	0	0	0	0						
13. Carbon Dioxide (mg/l)	3.3	2.3	4.1	3.2	8.4	7.4						
14. Chloride (mg/l)	19	21	23	21	19	19						
15. Chromium (ug/l)	10	0	10	0	0	10						
16. Cobalt (ug/l)	<9				< 4							
17. COD												
18. Coliform, Total & Fecal												
19. Color (PCU)												
20. Conductivity, Specific	2000	1780	2000	1900	1800	980						
21. Copper (ug/l)	0	1	1	2	3	2						
22. Cyanide (mg/l)	.00	.01	.00	.00	.00	.00						
23. Discharge (CFS)												
24. Discharge, Instantaneous	---	.81	.50	.72	.27	.43						
25. Dissolved Oxygen (mg/l)	4.4	10.4	7.6	13.8	10.2	7.9						
26. Fluoride (mg/l)	.3	.3	.3	.4	.3	.3						
27. Gallium (ug/l)	<4				<4							
28. Germanium (ug/l)	<13				<9							
29. Hardness (Ca, Mg) (mg/l)	750	790	760	790	790	650						
30. Hardness, Non-Carbonate (mg/l)	220	320	240	270	250	170						
31. Iron (ug/l)	80	120	40	60	0	[illegible]						
32. Kjeldahl Nitrogen (mg/l)	.42	.43	.79	.86	.41	[illegible]						
33. Lead (ug/l)	0	1	8	0	1	3						
34. Lithium (ug/l)	10	20	0	0	0	10						
35. Magnesium (mg/l)	110	120	100	120	120	91						
36. Manganese (ug/l)	80	10	250	190	110	120						
37. Mercury (ug/l)	.0	.1	.0	.0	.0	.1						
38. Molybdenum (ug/l)	60				55							
39. Nickel (ug/l)	<9				<9							
40. Nitrate (mg/l)	.22	5.7	2.2	3.9	2.8	3.2						
41. Nitrite (mg/l)	.00	.07	.13	.16	.13	.10						
42. Nitrite Plus Nitrate (mg/l)	.05	1.3	.54	.94	.68	.78						
43. Nitrogen, Ammonia	.01	.00	.00	.04	.00	.05						
44. Odor (Severity)	0	0	0	0	0	0						
45. Oil & Grease (mg/l)	0	2	4	1	2	1						
46. Ortho-Phosphate (mg/l)												
47. Ortho-Phosphorus (mg/l)												
48. Pesticides												
49. pH	7.5	8.6	8.4	8.5	8.1	8.1						
50. Phosphorus, Total (mg/l)	.01	.36	.04	.02	.02	.00						
51. Potassium (mg/l)	1.9	2.4	4.4	4.1	2.8	2.8						
52. Selenium (ug/l)	1	6	3	3	2	3						
53. Silica (mg/l)	19	15	21	17	20	17						
54. Silver (ug/l)	< 1				<1							
55. Sodium (mg/l)	190	170	180	190	180	170						
56. Sodium Adsorption Ratio	3.0	2.6	2.8	2.9	2.8	2.9						
57. Sodium ( )	35	32	34	34	33	36						
58. Solids, Dissolved (mg/l)	1370	1320	1390	1370	1360	1210						
59. Solids, Dissolved T/D	---	2.89	1.88	2.66	.99	1.40						
60. Solids, Dissolved T/Ac-Ft	1.86	1.80	1.89	1.86	1.85	1.65						
61. Solids, Suspended												
62. Strontium (ug/l)	2500				2300							
63. Sulfate (mg/l)	590	580	600	580	570	510						
64. Sulfide (mg/l)	.0	.0	.1	.0	.0	.0						
65. Temperature (°C)	10.0	13.0	20.0	23.0	12.0	20.5						
66. Tin (ug/l)	<9				<9							
67. Titanium (ug/l)	<5				<4							
68. Turbidity (JTU)	2	20	6	5	0	1						
69. Vanadium (ug/l)	<9.0				<4.0							
70. Zinc (ug/l)	10	10	10	20	10	10						
71. Zirconium (ug/l)												
72. Calcium (mg/l)	120	120	140	120	120	110						
73. Complete Element Spec												
74. Radioactivity												
Gross Alpha (pc												
Radium 226*												
Gross Beta												
Thorium 230**												
Uranium**												
75. Total Organic Carbon (mg/l)	11											
If TOC 10 mg/liter, then												
Nitrogen (Base Extraction)												
Organic Carbon, Dissolved												
Organic Carbon, Suspended												
Phenols												
Sulfur (Acid Extraction)												
76. Total Ortho-Phosphorous	.01	.00	.01	.01	.01	.01						
77. Phosphate												
78. Phosphorus, Dissolved	.01	.00	.02	.00	.01	.01						

TABLE 1.2-7

SUMMARY WATER ANALYSIS

STREAM GAGING STATION, USGS 09306255

YELLOW CREEK NEAR WHITE RIVER

Date Time	3/12/75 1400	3/26/75 1030	4/9/75 1200	4/9/75 1300	4/23/75 1000	5/15/75 1100	5/28/75 1115	6/13/75 1115	6/26/75 1330	7/16/75 1045	7/29/75 0920	8/14/75 0915
1. Alkalinity (mg/l)	1330	1330	1380	1580	1220	1380	1270	1460	1500	1280	1580	1510
2. Aluminum (ug/l)	150	---	---	---	---	---						
3. Ammonia (mg/l)	.00	.22	.24	.30	.00	.08	.00	.01	.03	.00	.05	.00
4. Aromatics, Polycyclic												
5. Arsenic (ug/l)	5	3	1	5	6	5	5	5	9	6	4	6
6. Barium (ug/l)	200	100	<100	300	0	300	200	300	200	400	0	400
7. Beryllium (ug/l)	<4	---	---	---	---	---						
8. Bicarbonate (mg/l)	1620	1210	1480	930	1490	1510	1150	1490	1550	1340	596	1220
9. Bismuth (ug/l)	<15	---	---	---	---	---						
10. Boron (ug/l)	560	630	680	700	630	640	640	730	740	670	690	720
11. Cadmium (ug/l)	<170	0	0	0	1	2	1	0	0	1	1	0
12. Carbonate (mg/l)	0	203	97	0	1	87	194	140	139	107	657	308
13. Carbon Dioxide (mg/l)	10	5.2	4.3	6.2	3.8	5.4	---	1.1	2.3	7.9	3.9	12
14. Chloride (mg/l)	130	110	130	130	120	120	100	130	130	110	140	140
15. Chromium (ug/l)	<15	0	0	0	0	0	0	0	0	0	0	0
16. Cobalt (ug/l)	<15	---	---	---	---	---						
17. COD	7	---	---	---	---	---						
18. Coliform, Total & Fecal												
19. Color (PVC)	3	10	3	2	4	3	20	20	20	45	20	20
20. Conductivity, Specific	3500	3600	3250	3400	3500	3000	3020	4000	4200	3800	3500	4000
21. Copper (ug/l)	5	0	3	1	7	3	2	1	3	4	4	2
22. Cyanide (mg/l)	.00	.00	---	.00	.00	.00	.00	.00	.00	.00	.00	.00
23. Discharge (CFS)	---	---	---	---	---	---						
24. Discharge, Instantaneous	2.9	2.2	1.2	3.3	1.9	1.7	---	---	1.1	1.9	1.1	---
25. Dissolved Oxygen (mg/l)	8.5	10.6	10.4	9.1	9.6	7.6	9.7	8.6	8.4	7.4	11.0	8.1
26. Fluoride (mg/l)	2.0	1.9	1.2	1.6	2.1	2.1	2.0	2.4	2.4	1.8	2.5	2.2
27. Gallium (ug/l)	<5	---	---	---	---	---						
28. Germanium (ug/l)	<20	---	---	---	---	---						
29. Hardness (Ca, Mg) (mg/l)	550	650	500	590	550	570	500	550	500	500	490	510
30. Hardness, Non-Carbonate (mg/l)	0	0	0	0	0	0	0	0	0	0	0	0
31. Iron (ug/l)	65	20	10	10	30	40	660	20	10	20	90	10
32. Kjeldahl Nitrogen (mg/l)	.17	.71	---	2.6	.60	.30	1.4	.98	.45	.86	.57	.52
33. Lead (ug/l)	<16	0	0	0	9	4	5	1	1	0	2	1
34. Lithium (ug/l)	160	120	120	140	130	170	120	170	160	130	160	160
35. Magnesium (mg/l)	110	130	98	120	130	120	100	120	110	96	110	110
36. Manganese (ug/l)	14	20	10	10	30	10	50	0	0	0	20	10
37. Mercury (ug/l)	.0	.0	.3	.0	.0	.2	.0	.0	.0	.0	.0	.0
38. Molybdenum (ug/l)	30	---	---	---	---	---						
39. Nickel (ug/l)	<10	---	---	---	---	---						
40. Nitrate (mg/l)	9.3	6.6	9.7	7.9	4.4	2.5	1.5	.04	.49	2.2	4.4	1.2
41. Nitrite (mg/l)	.00	.03	.03	.03	.03	.03	.03	.00	.07	.03	.03	.20
42. Nitrite Plus Nitrate (mg/l)	2.1	1.5	2.2	1.8	1.0	.58	.35	.01	.13	.51	1.0	.34
43. Nitrogen, Ammonia	.00	.17	.19	.23	.00	.06	.00	.01	.02	.00	.04	.00
44. Odor (Severity)	2	2	---	---	0	0	0	0	0	0	0	0
45. Oil & Grease (mg/l)	3	3	---	2	2	1	1	0	---	1	E1	0
46. Ortho-Phosphate (mg/l)	.15	.37	.34	.15	.12	.06	.06	.00	.03	.00	.00	.00
47. Ortho-Phosphorus (mg/l)	.05	.12	.11	.05	.04	.02	.02	.00	.01	.00	.00	.00
48. Pesticides												
49. pH	8.4	8.7	8.8	8.7	8.8	8.7	---	9.4	9.1	8.5	8.9	8.4
50. Phosphorus, Total (mg/l)	.02	.13	---	.79	.09	.04	.10	.01	.01	.24	.03	.05
51. Potassium (mg/l)	4.6	3.5	3.8	4.4	7.4	3.9	4.5	3.5	3.6	5.5	3.9	5.0
52. Selenium (ug/l)	3	2	3	3	1	1	3	2	2	2	2	3
53. Silica (mg/l)	20	14	14	14	11	7.1	5.7	1.9	3.7	14	.3	1.1
54. Silver (ug/l)	<2	---	---	---	---	---						
55. Sodium (mg/l)	710	700	680	840	710	740	680	780	780	700	810	800
56. Sodium Adsorption Ratio	13	12	13	15	13	13	13	15	15	14	16	15
57. Sodium (%)	74	70	75	75	73	74	74	76	77	75	73	77
58. Solids, Dissolved (mg/l)	2320	2450	2270	2740	2330	2430	2250	2540	2530	2280	2550	2520
59. Solids, Dissolved T/D	18.6	14.6	7.66	25.0	12.0	11.2	---	---	7.51	12.1	7.57	---
60. Solids, Dissolved T/Ac-Ft	3.16	3.33	3.09	3.73	3.17	3.30	3.06	3.45	3.44	3.10	3.47	3.43
61. Solids, Suspended												
62. Strontium (ug/l)	3500	---	---	---								
63. Sulfate (mg/l)	490	640	470	630	600	570	560	600	580	540	510	530
64. Sulfide (mg/l)	.0	.1	.3	.2	.1	.1	.0	.3	.3	.1	.0	.0
65. Temperature (°C)	9.0	3.5	6.0	9.0	9.0	17.0	9.5	21.5	24.0	19.0	17.0	14.0
66. Tin (ug/l)	<15	---	---	---	---	---						
67. Titanium (ug/l)	<10	---	---	---	---	---						
68. Turbidity JTU)	3	85	3	400	56	18	230	23	4	150	12	44
69. Vanadium (ug/l)	<8.0	---	---	---	---	---						
70. Zinc (ug/l)	6	0	6	20	0	6	30	10	10	20	40	10
71. Zirconium (ug/l)	<25	---	---	---	---	---						
72. Calcium (mg/l)	37	45	37	40	7.0	31						
73. Complete Element Span												
74. Radioactivity												
Gross Alpha (pci)	<36	---	---	---	---	---						
Radium 226*												
Gross Beta	8.8	---	---	---	---	---						
Thorium 230**												
Uranium**												
75. Total Organic Carbon (mg/l)	4.7	---	---	---	---	---						
If TOC >10 mg/liter, then												
Nitrogen (Base Extraction)												
Organic Carbon, Dissolved												
Organic Carbon, Suspended												
Phenols												
Sulfur (Acid Extraction)												
76. Total Ortho-Phosphorous (mg/l)	.06	.12	.30	.42	.01	.01	.02	.01	.01	.05	.00	.02
77. Phosphate	---	---	---	---	.28	.12	.31	.03	.03	.74	.09	.15
78. Phosphorus, Dissolved	---	---	---	---	---	---	---	---	---	---	---	---

TABLE 1.2-7

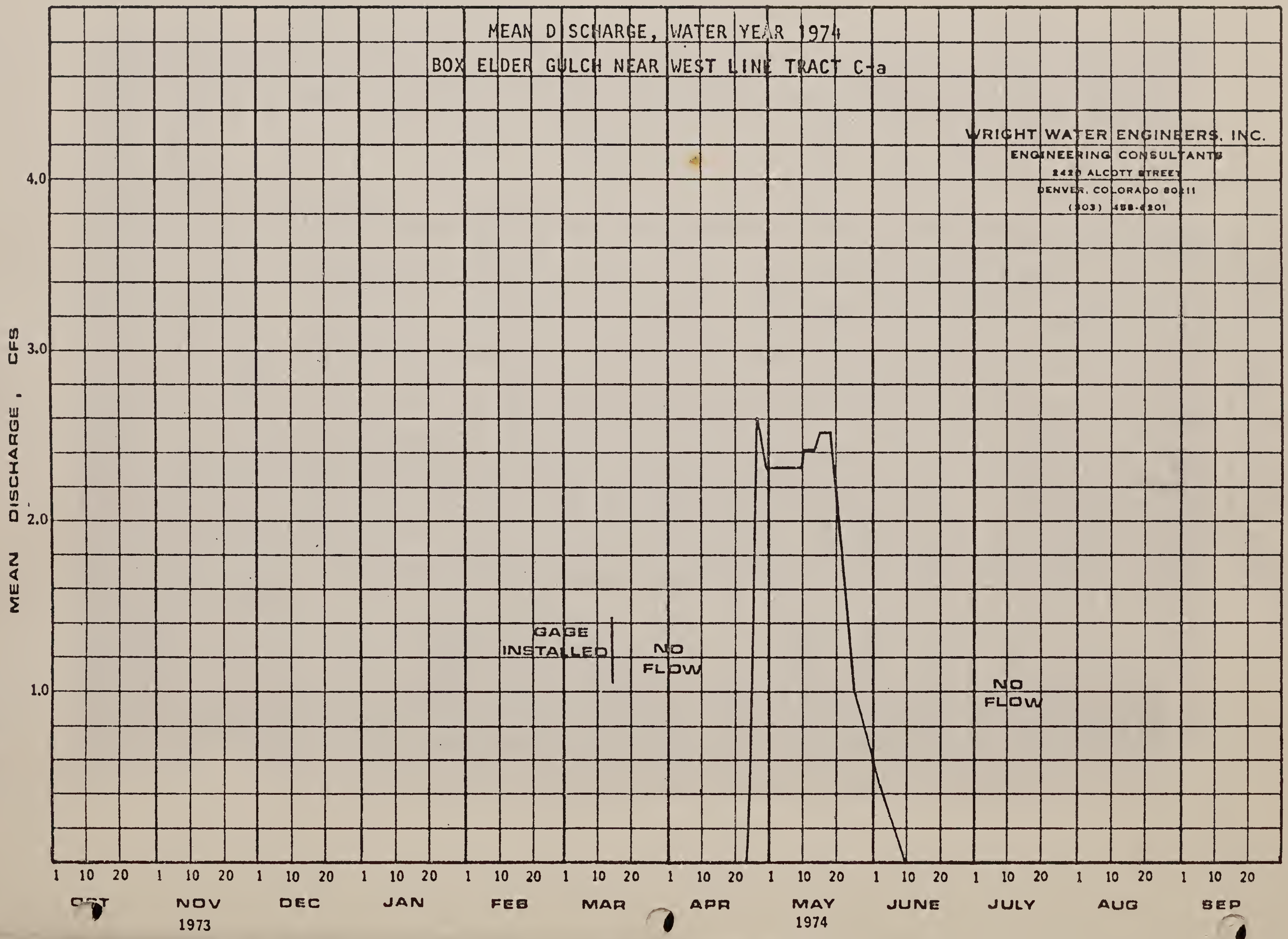
(CONTINUED)

SUMMARY WATER ANALYSIS

STREAM GAGING STATION, USGS 09306255

YELLOW CREEK NEAR WHITE RIVER

	9/10/75 1205	9/24/75 1045	10/15/75 1000
1. Alkalinity (mg/l)	1550	1560	1590
2. Aluminum (ug/l)	75		
3. Ammonia (mg/l)	0.0	0.04	0.04
4. Aromatics, Polycyclic			
5. Arsenic (ug/l)	4	7	5
6. Barium (ug/l)	200	200	200
7. Beryllium (ug/l)	<4		
8. Bicarbonate (mg/l)	1620	1900	1790
9. Bismuth (ug/l)	<20		
10. Boron (ug/l)	770	680	690
11. Cadmium (ug/l)	1	1	0
12. Carbonate (mg/l)	135	0	75
13. Carbon Dioxide (mg/l)	0.2	24	7.8
14. Chloride (mg/l)	150	140	130
15. Chromium (ug/l)	80	10	0
16. Cobalt (ug/l)	<10		
17. COD			
18. Coliform, Total & Fecal			
19. Color (PCU)			
20. Conductivity, Specific	4000	4000	4000
21. Copper (ug/l)	4	4	0
22. Cyanide (mg/l)	0	0	0
23. Discharge (CFS)			
24. Discharge, Instantaneous	0.0	1.3	0.92
25. Dissolved Oxygen (mg/l)	9.9	12.2	
26. Fluoride (mg/l)	2.3	2.3	2.1
27. Gallium (ug/l)	<10		
28. Germanium (ug/l)			
29. Hardness (Ca, Mg) (mg/l)	520	570	570
30. Hardness, Non-Carbonate (mg/l)	0	0	0
31. Iron (ug/l)	20	10	10
32. Kjeldahl Nitrogen (mg/l)	0.89	0.48	0.76
33. Lead (ug/l)	4	0	0
34. Lithium (ug/l)	120	160	150
35. Magnesium (mg/l)	110	120	120
36. Manganese (ug/l)	0	10	10
37. Mercury (ug/l)	0.0	0.0	0.1
38. Molybdenum (ug/l)	55		
39. Nickel (ug/l)	<20		
40. Nitrate (mg/l)	2.8	3.4	2.9
41. Nitrite (mg/l)	0.2	0.03	0.03
42. Nitrite Plus Nitrate (mg/l)	0.7	0.78	0.66
43. Nitrogen, Ammonia	.00	.03	.03
44. Odor (Severity)	0	0	0
45. Oil & Grease (mg/l)	1	0	0
46. Ortho-Phosphate (mg/l)			
47. Ortho-Phosphorus (mg/l)			
48. Pesticides			
49. pH	10.1	8.1	8.6
50. Phosphorus, Total (mg/l)			
51 Potassium (mg/l)	4.8	3.7	4.3
52 Selenium (ug/l)	2	2	2
53 Silica (mg/l)	8.9	9.3	6.4
54 Silver (ug/l)	< 2		
55 Sodium (mg/l)	820	830	800
56 Sodium Adsorption Ratio	16	15	15
57. Sodium ( )	77	76	75
58. Solids, Dissolved (mg/l)	2570	2600	2640
59. Solids, Dissolved T/D		9.69	6.56
60. Solids, Dissolved T/Ac-Ft	3.5	3.54	3.59
61. Solids, Suspended			
62. Strontium (ug/l)	3000		
63. Sulfate (mg/l)	510	520	580
64. Sulfide (mg/l)	0.0	0.0	0.2
65. Temperature (°C)	19.5	8.5	1.5
66. Tin (ug/l)	<20		
67. Titanium (ug/l)	<10		
68. Turbidity JTU)	20	20	5
69. Vanadium (ug/l)	<10		
70. Zinc (ug/l)	0	10	10
71. Zirconium (ug/l)			
72. Calcium (mg/l)	25	31	32
73. Complete Element Span			
74. Radioactivity			
Gross Alpha (pci)			
Radium 226*			
Gross Beta			
Thorium 230**			
Uranium**			
75. Total Organic Carbon (mg/l)	29		
If TOC 10 mg liter, then			
Nitrogen (Base Extraction)			
Organic Carbon, Dissolved	22		
Organic Carbon, Suspended			
Phenols			
Sulfur (Acid Extraction)			
76 Total Ortho-Phosphorous (mg/l)	0.2	0.2	0.2
77. Phosphate			
78. Phosphorus, Dissolved	0.04	0.04	0.02

MEAN DISCHARGE, WATER YEAR 1974
BOX ELDER GULCH NEAR WEST LINE TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MEAN DISCHARGE, CFS
4.0
3.0
2.0
1.0
GAGE INSTALLED
NO FLOW
NO FLOW
1 10 20
OCT
NOV
1973
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JAN
FEB
MAR
APR
MAY
1974
JUNE
JULY
AUG
SEP

Figure 1.2-2

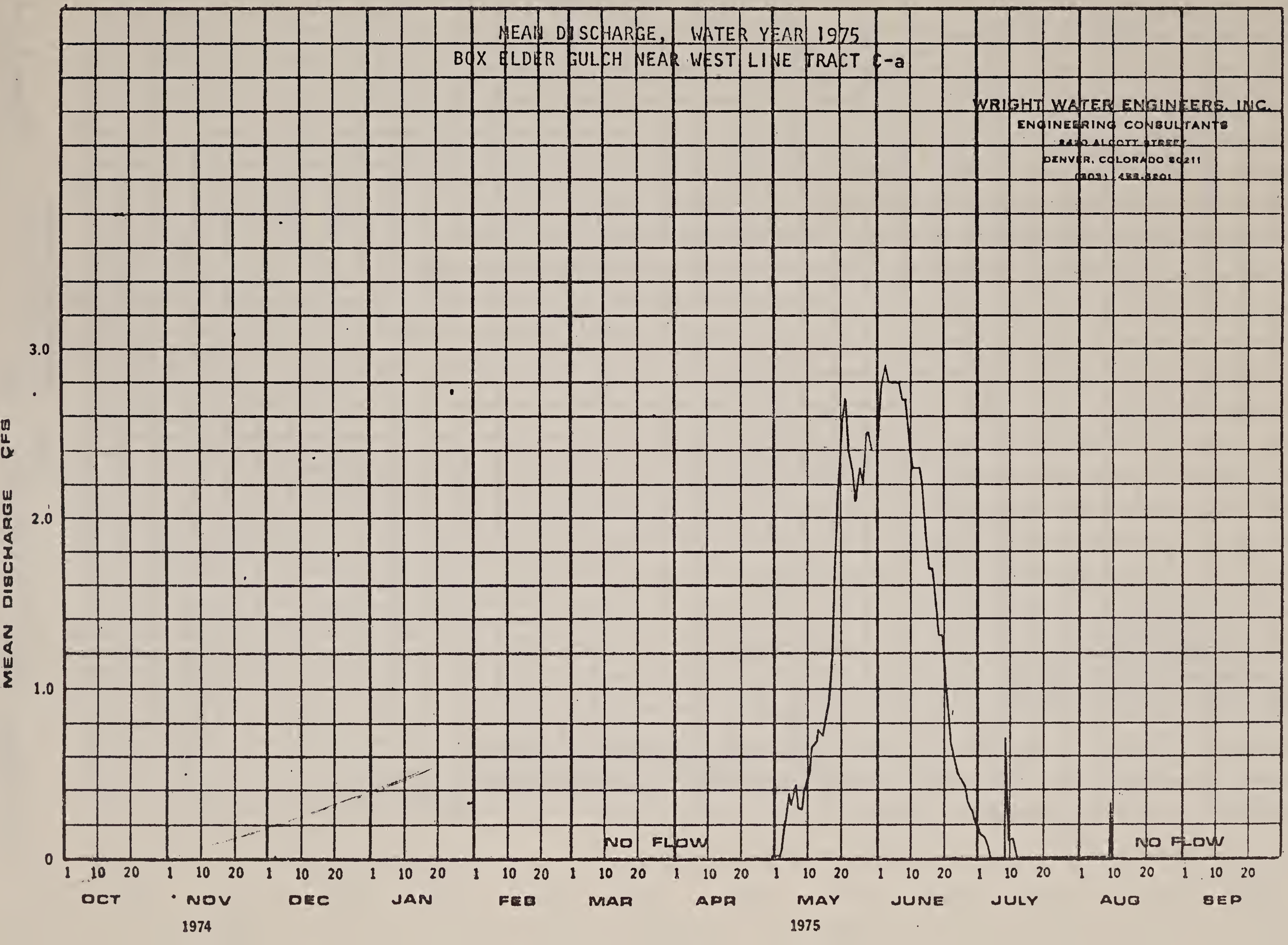
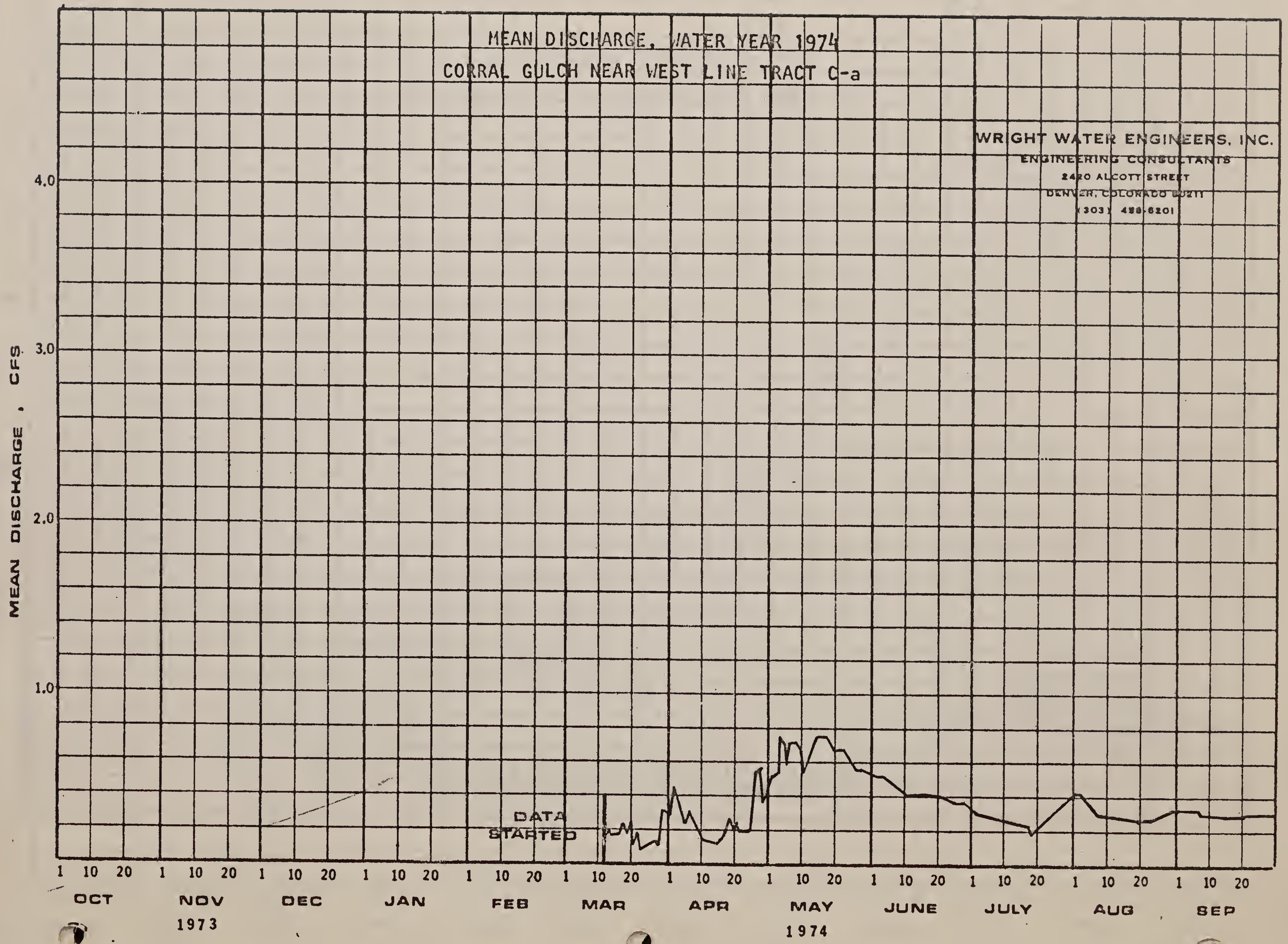

MEAN DISCHARGE, WATER YEAR 1975
BOX ELDER GULCH NEAR WEST LINE TRACT C-a

Figure 1.2-3


MEAN DISCHARGE, WATER YEAR 1974
CORRAL GULCH NEAR WEST LINE TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MEAN DISCHARGE, CFS
4.0
3.0
2.0
1.0
DATA STARTED
1 10 20
OCT
1 10 20
NOV
1973
1 10 20
DEC
1 10 20
JAN
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1 10 20
MAR
1 10 20
APR
1 10 20
MAY
1974
1 10 20
JUNE
1 10 20
JULY
1 10 20
AUG
1 10 20
SEP

Figure 1.2-4

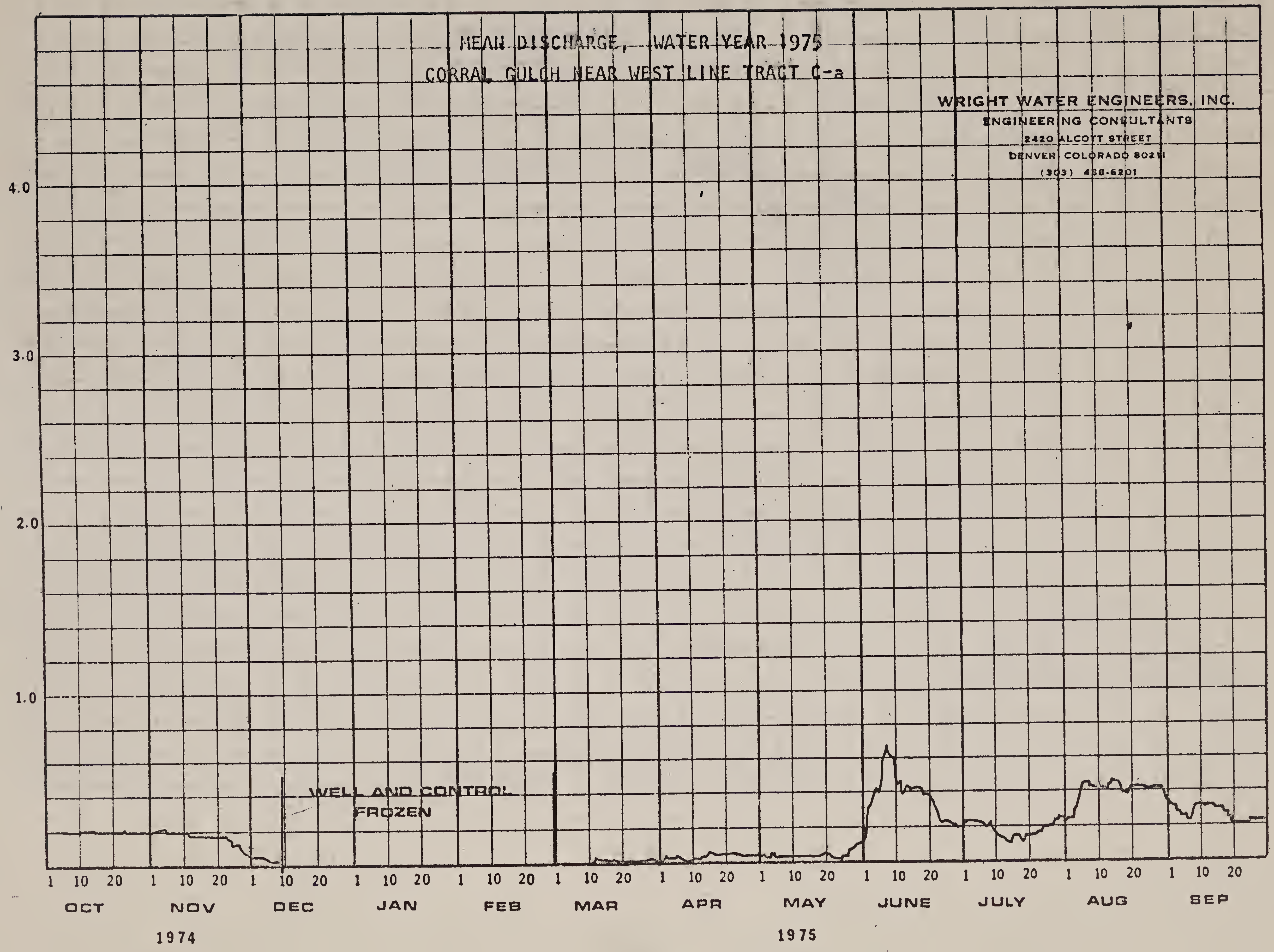
MEAN DISCHARGE, WATER YEAR 1975
CORRAL GULCH NEAR WEST LINE TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER COLORADO 80211
(303) 436-6201
MEAN DISCHARGE CFS
4.0
3.0
2.0
1.0
WELL AND CONTROL
FROZEN
1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1974
1975

Figure 1.2-5

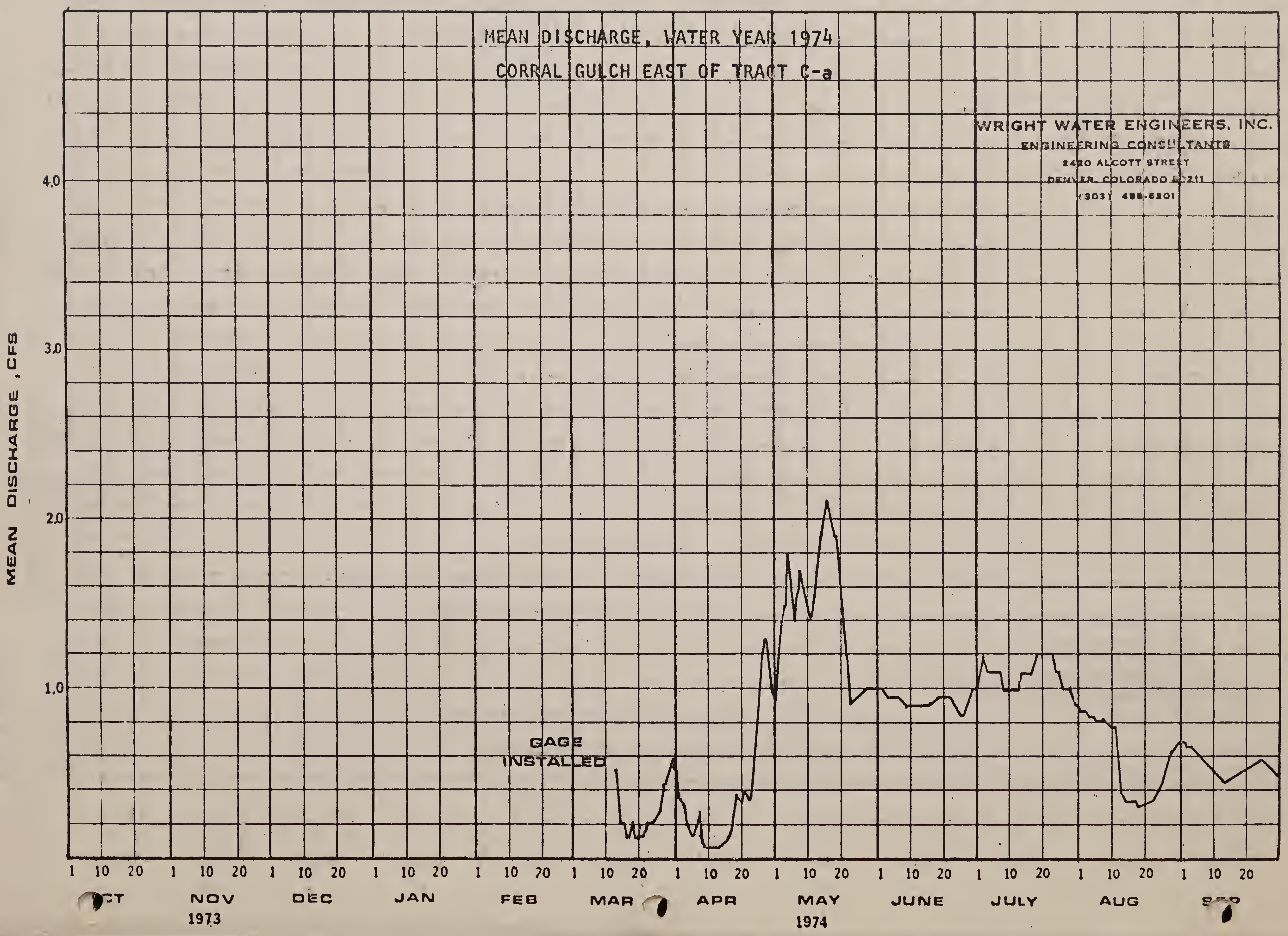

MEAN DISCHARGE, WATER YEAR 1974
CORRAL GULCH EAST OF TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MEAN DISCHARGE ,CFS
4.0
3.0
2.0
1.0
GAGE INSTALLED
1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20
OCT
NOV
1973
DEC
JAN
FEB
MAR
APR
MAY
1974
JUNE
JULY
AUG
SEP

Figure 1.2-6

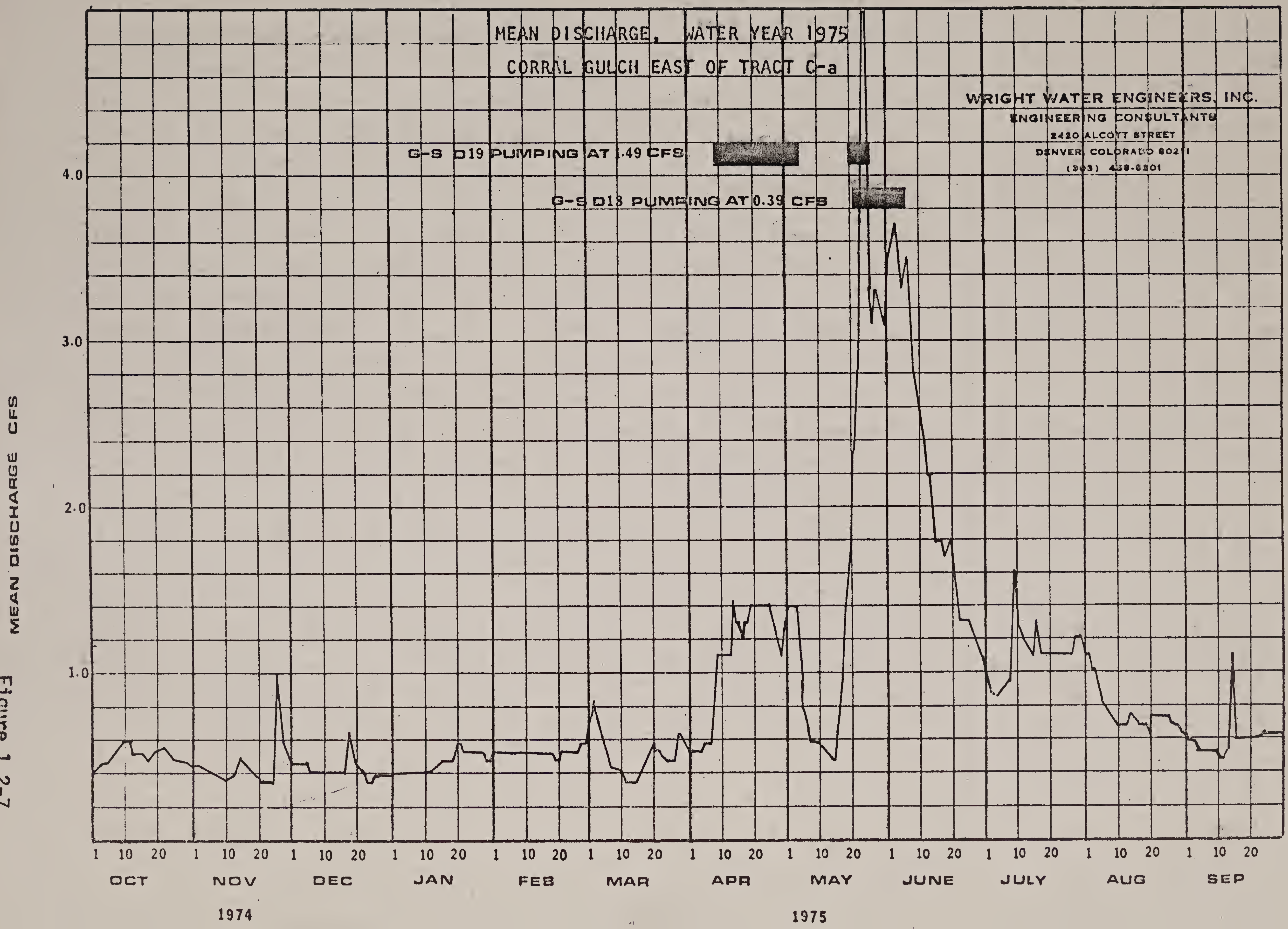

MEAN DISCHARGE, WATER YEAR 1975
CORRAL GULCH EAST OF TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
G-S D19 PUMPING AT 1.49 CFS
G-S D18 PUMPING AT 0.39 CFS
MEAN DISCHARGE CFS
4.0
3.0
2.0
1.0
1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1974
1975

Figure 1.2-7

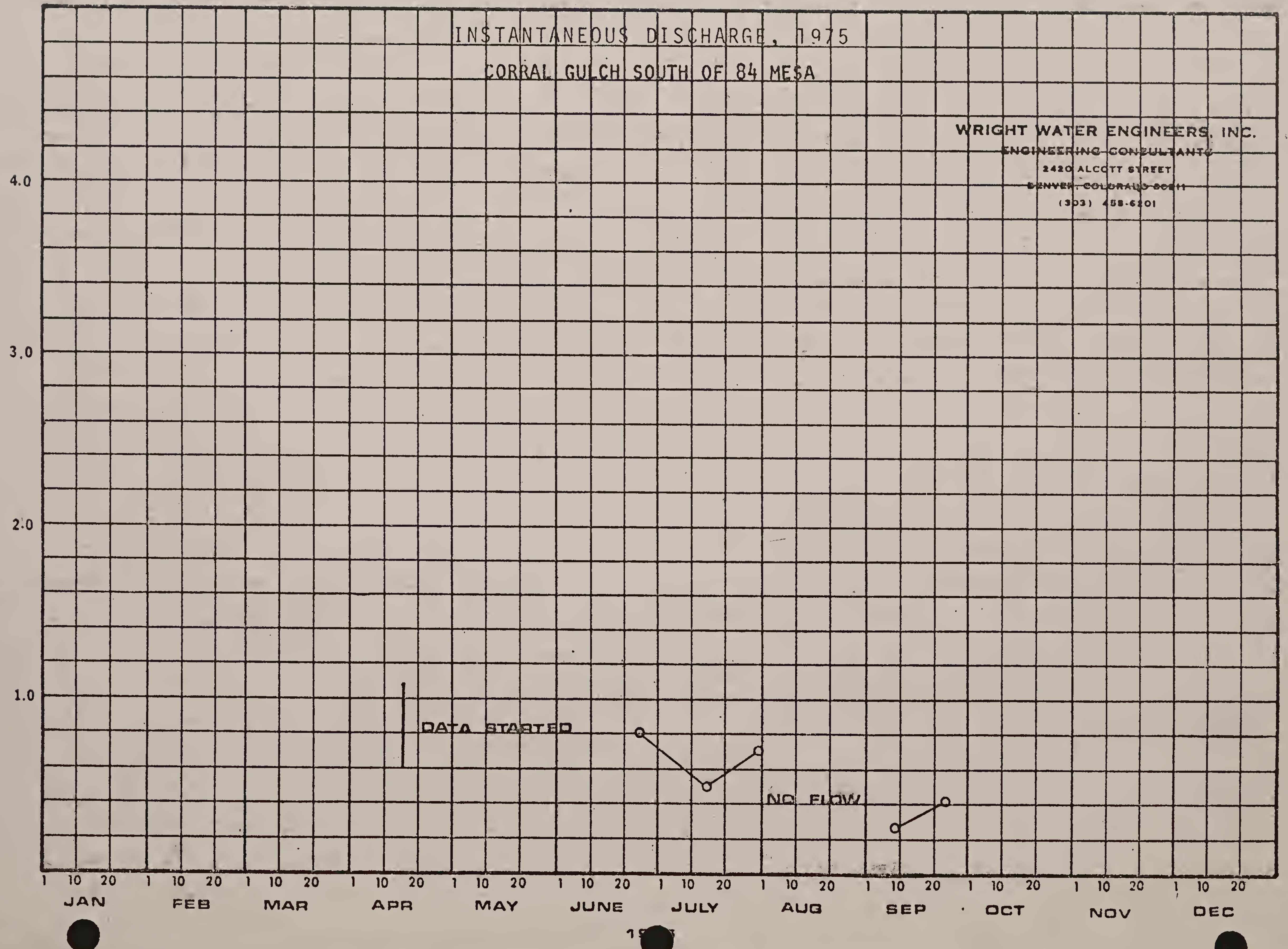

INSTANTANEOUS DISCHARGE, 1975
CORRAL GULCH SOUTH OF 84 MESA
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
DISCHARGE IN CFS
4.0
3.0
2.0
1.0
DATA STARTED
NO FLOW
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC

Figure 1.2-8

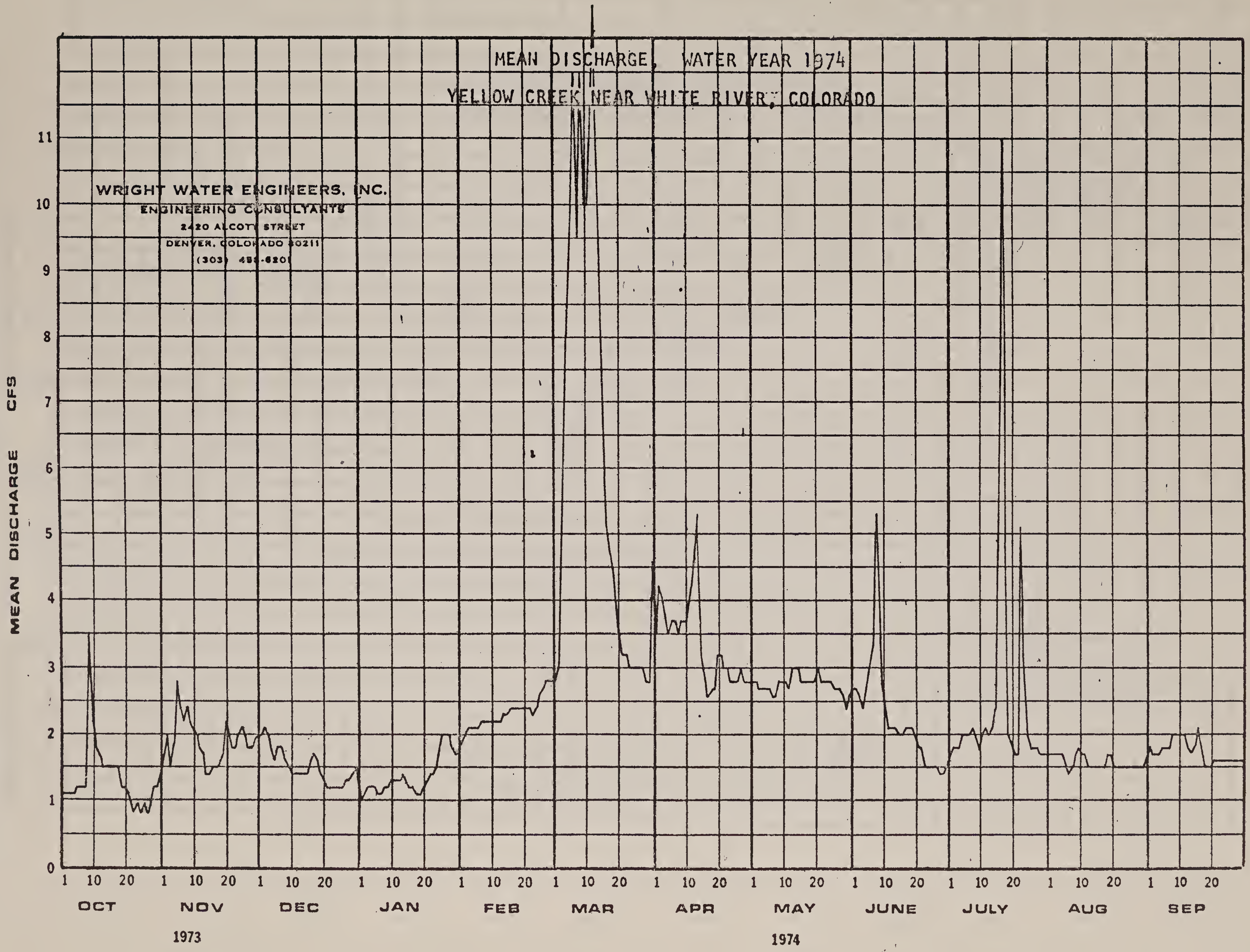

MEAN DISCHARGE, WATER YEAR 1974
YELLOW CREEK NEAR WHITE RIVER, COLORADO
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MEAN DISCHARGE CFS
0
1
2
3
4
5
6
7
8
9
10
11
1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1973
1974

Figure 1.2-9

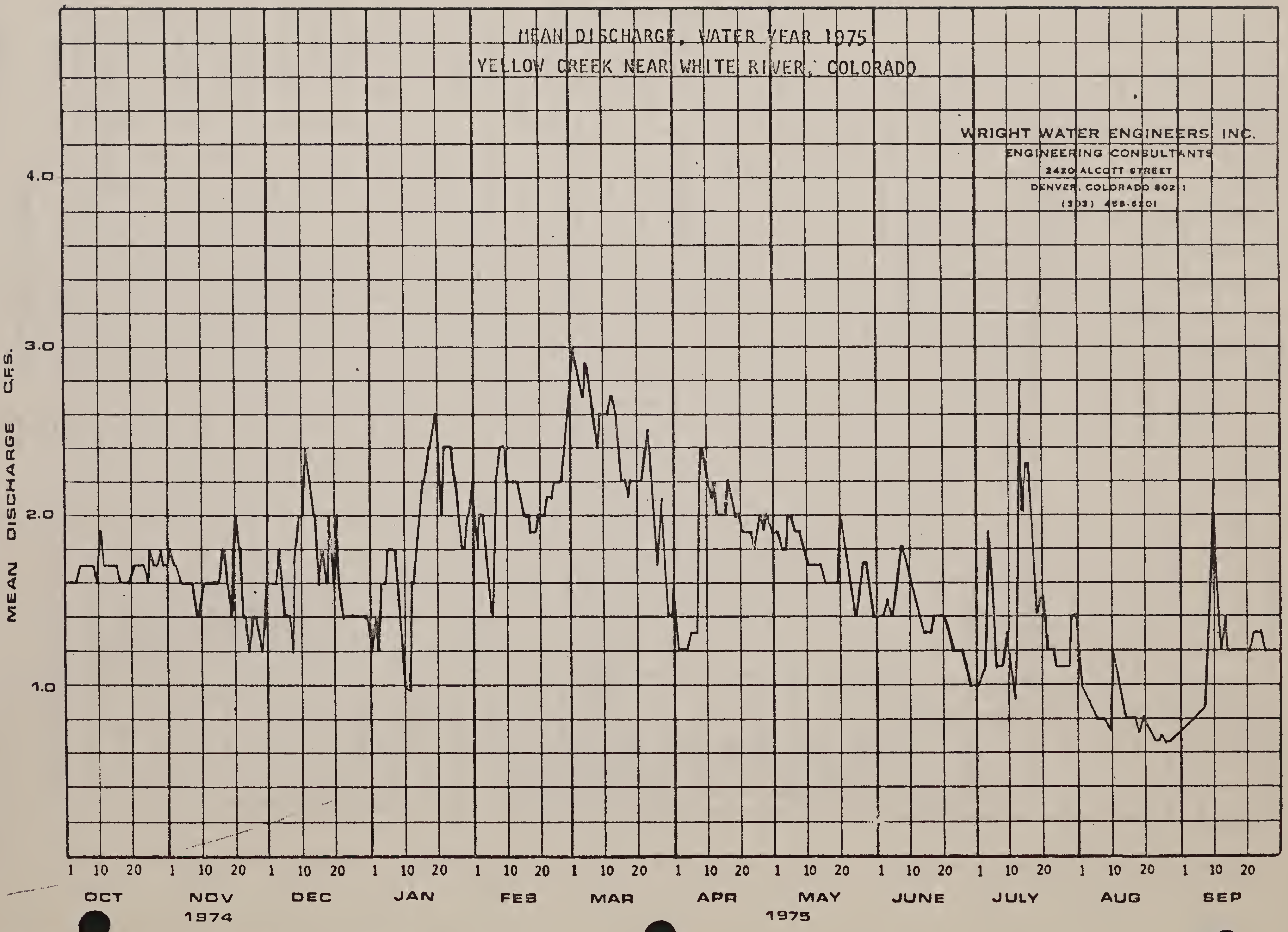

MEAN DISCHARGE, WATER YEAR 1975
YELLOW CREEK NEAR WHITE RIVER, COLORADO
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MEAN DISCHARGE C.F.S.
4.0
3.0
2.0
1.0
1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20
OCT
NOV
1974
DEC
JAN
FEB
MAR
APR
1975
MAY
JUNE
JULY
AUG
SEP

Figure 1.2-10

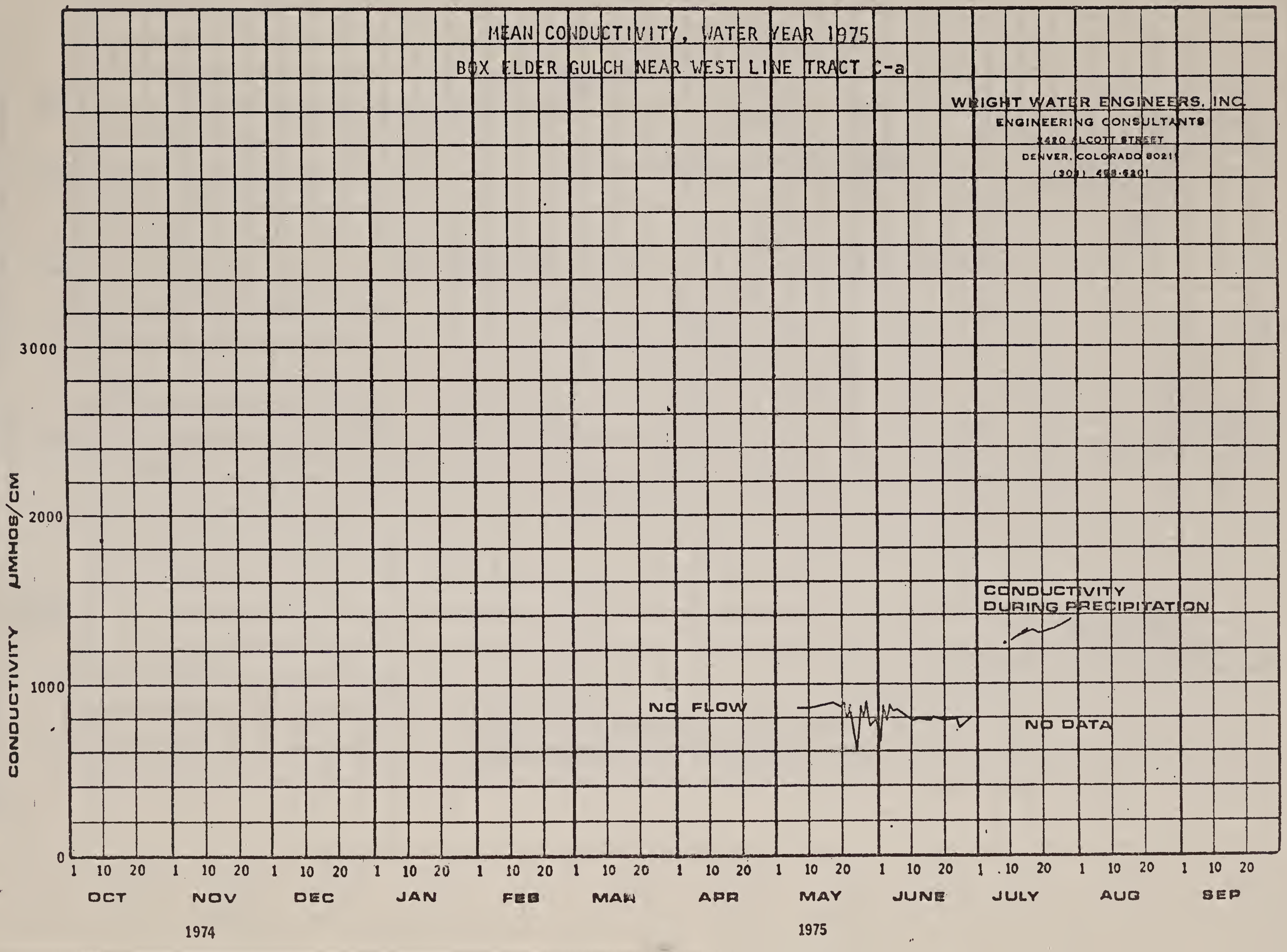
MEAN CONDUCTIVITY, WATER YEAR 1975
BOX ELDER GULCH NEAR WEST LINE TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
CONDUCTIVITY µMHOS/CM
3000
2000
1000
0
NO FLOW
NO DATA
CONDUCTIVITY DURING PRECIPITATION
1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1974
1975

Figure 1.2-11

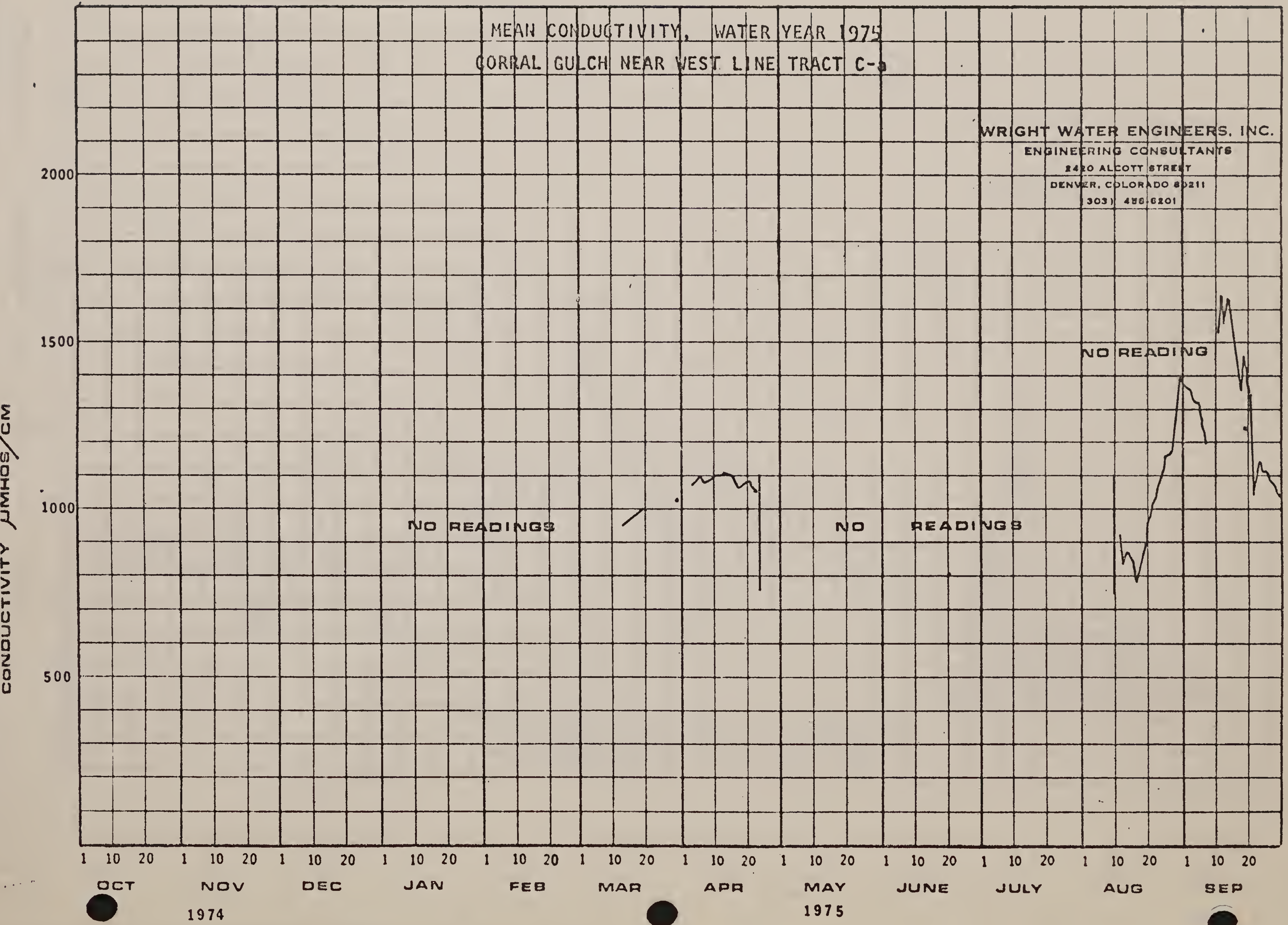

MEAN CONDUCTIVITY, WATER YEAR 1975
CORRAL GULCH NEAR WEST LINE TRACT C-a

Figure 1.2-12

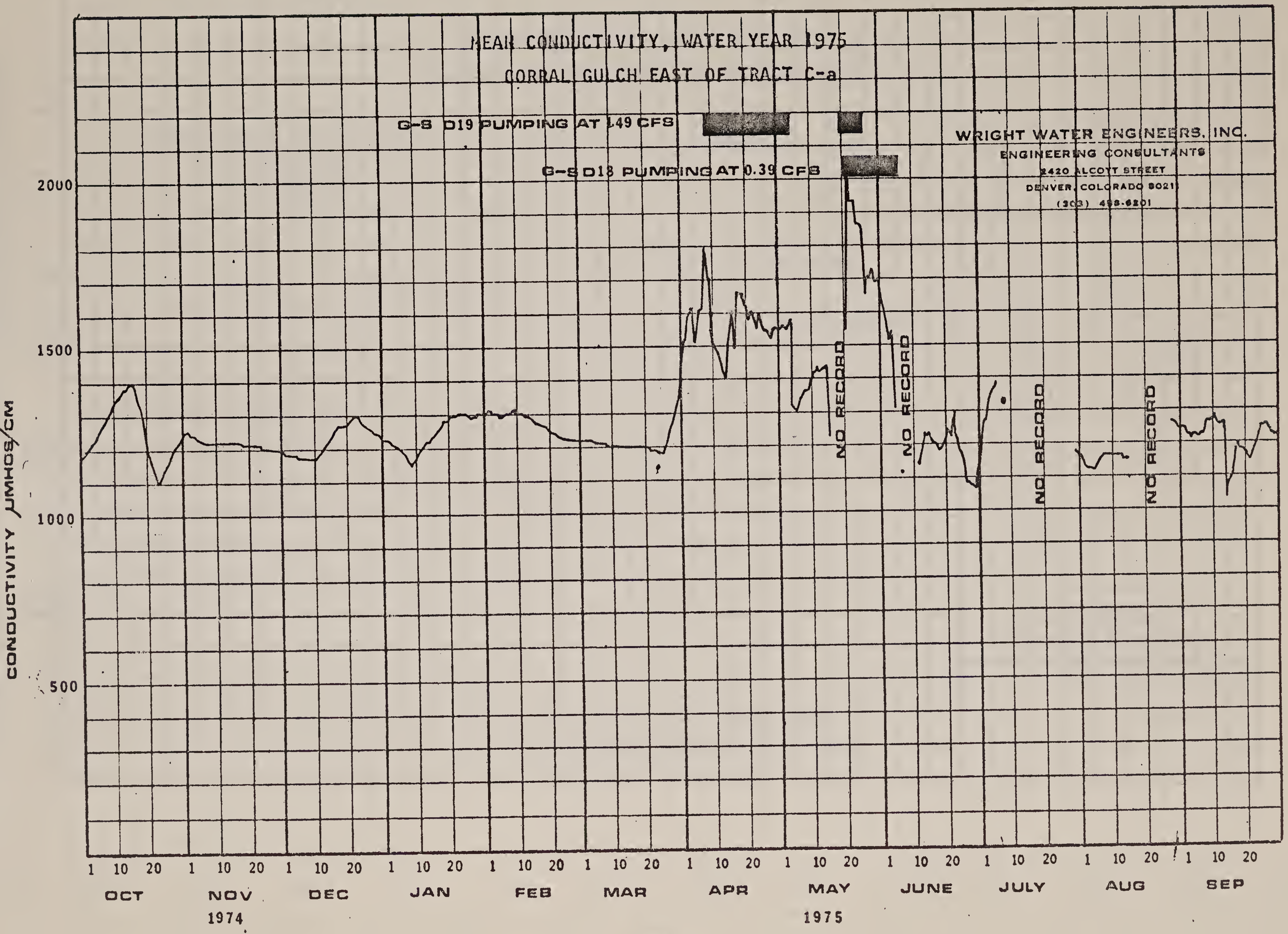

MEAN CONDUCTIVITY, WATER YEAR 1975
CORRAL GULCH EAST OF TRACT C-a
G-S D19 PUMPING AT 149 CFS
G-S D18 PUMPING AT 0.39 CFS
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
CONDUCTIVITY µMHOS/CM
2000
1500
1000
500
NO RECORD
NO RECORD
NO RECORD
NO RECORD
1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1974
1975

Figure 1.2-13

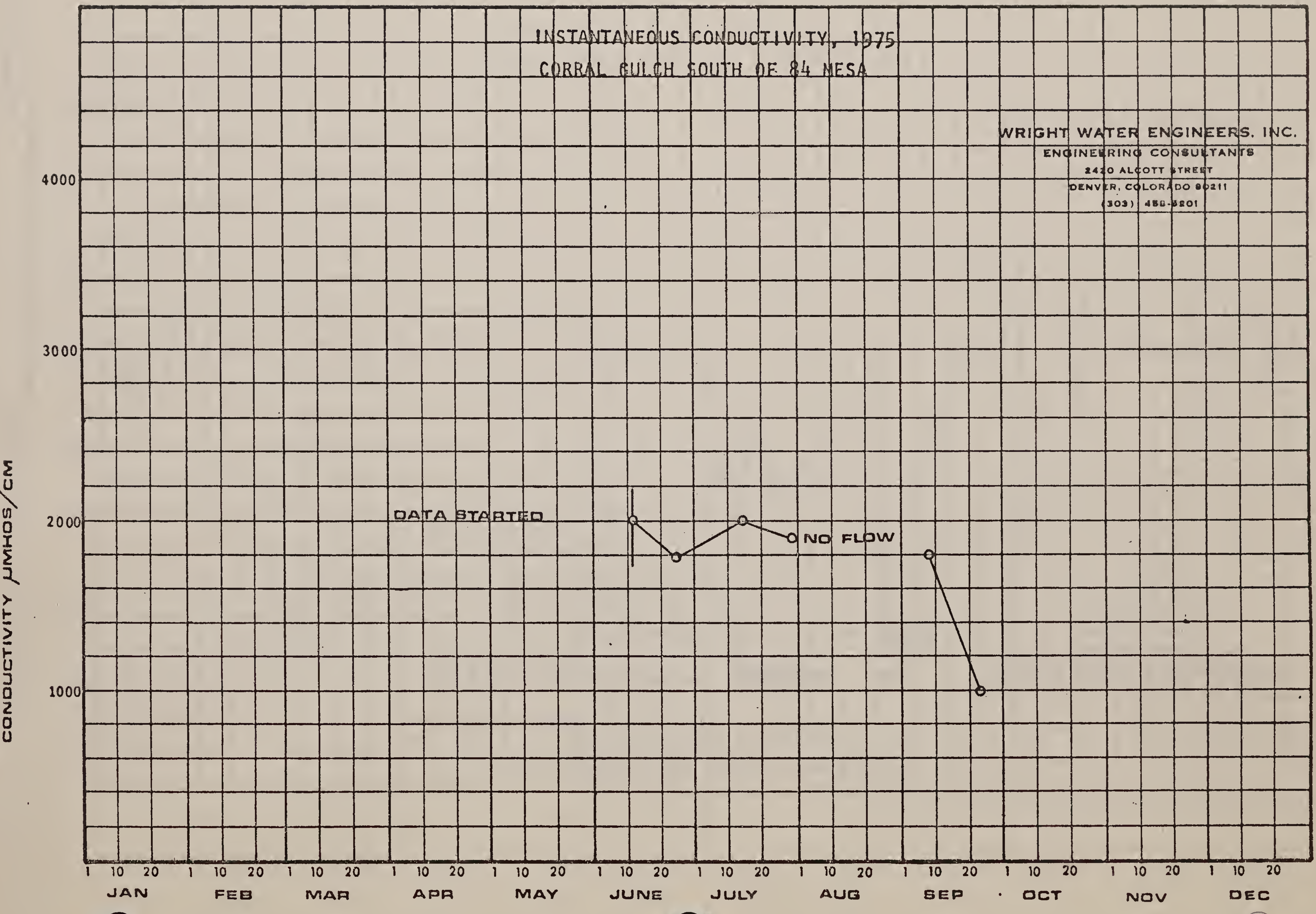

INSTANTANEOUS CONDUCTIVITY, 1975
CORRAL GULCH SOUTH OF 84 MESA
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
CONDUCTIVITY μmhos/cm
4000
3000
2000
1000
DATA STARTED
NO FLOW
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1975

Figure 1.2-14

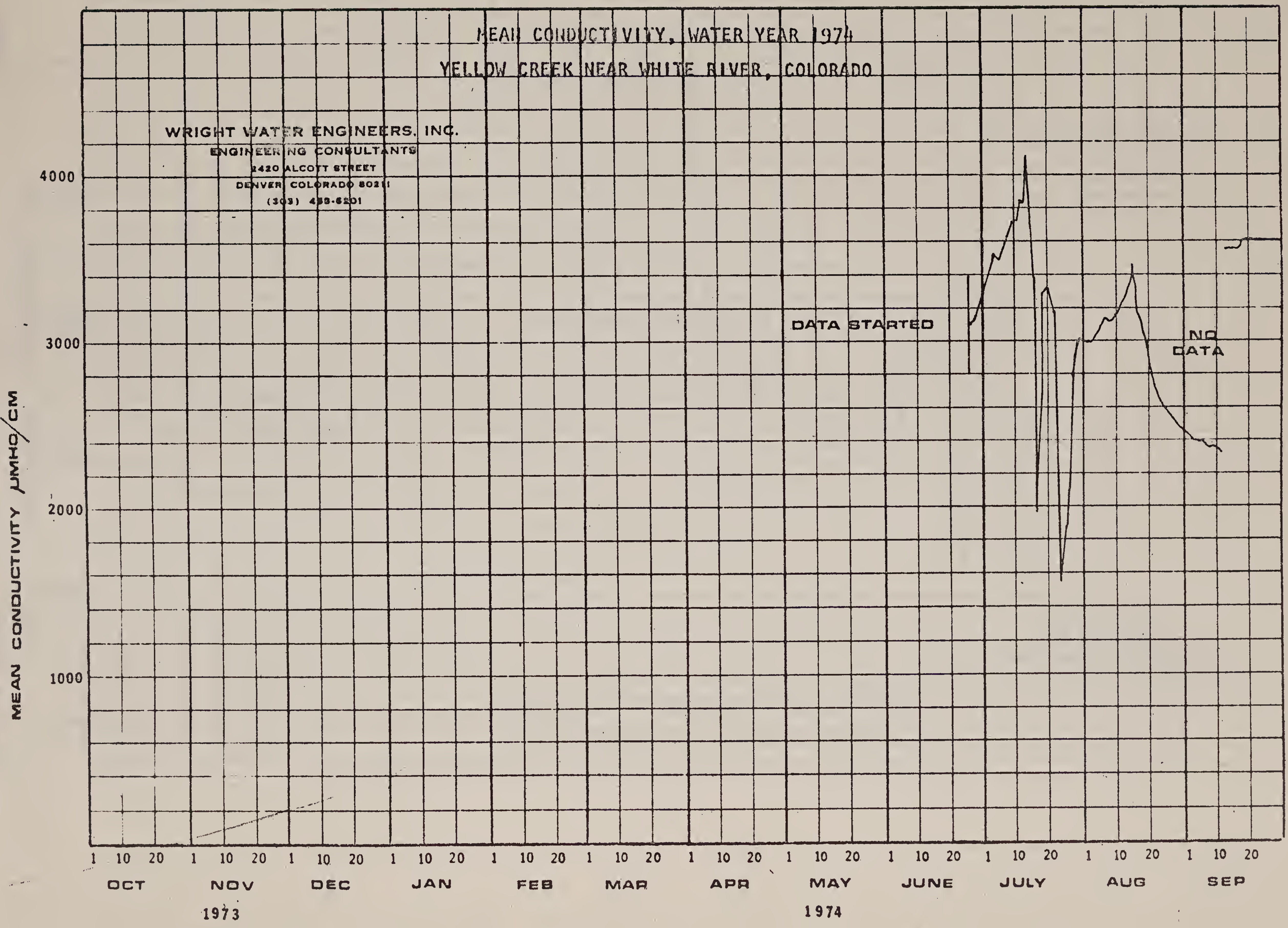

MEAN CONDUCTIVITY, WATER YEAR 1974
YELLOW CREEK NEAR WHITE RIVER, COLORADO
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
DATA STARTED
NO DATA
MEAN CONDUCTIVITY µMHO/CM
4000
3000
2000
1000
1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1973
1974

Figure 1.2-15

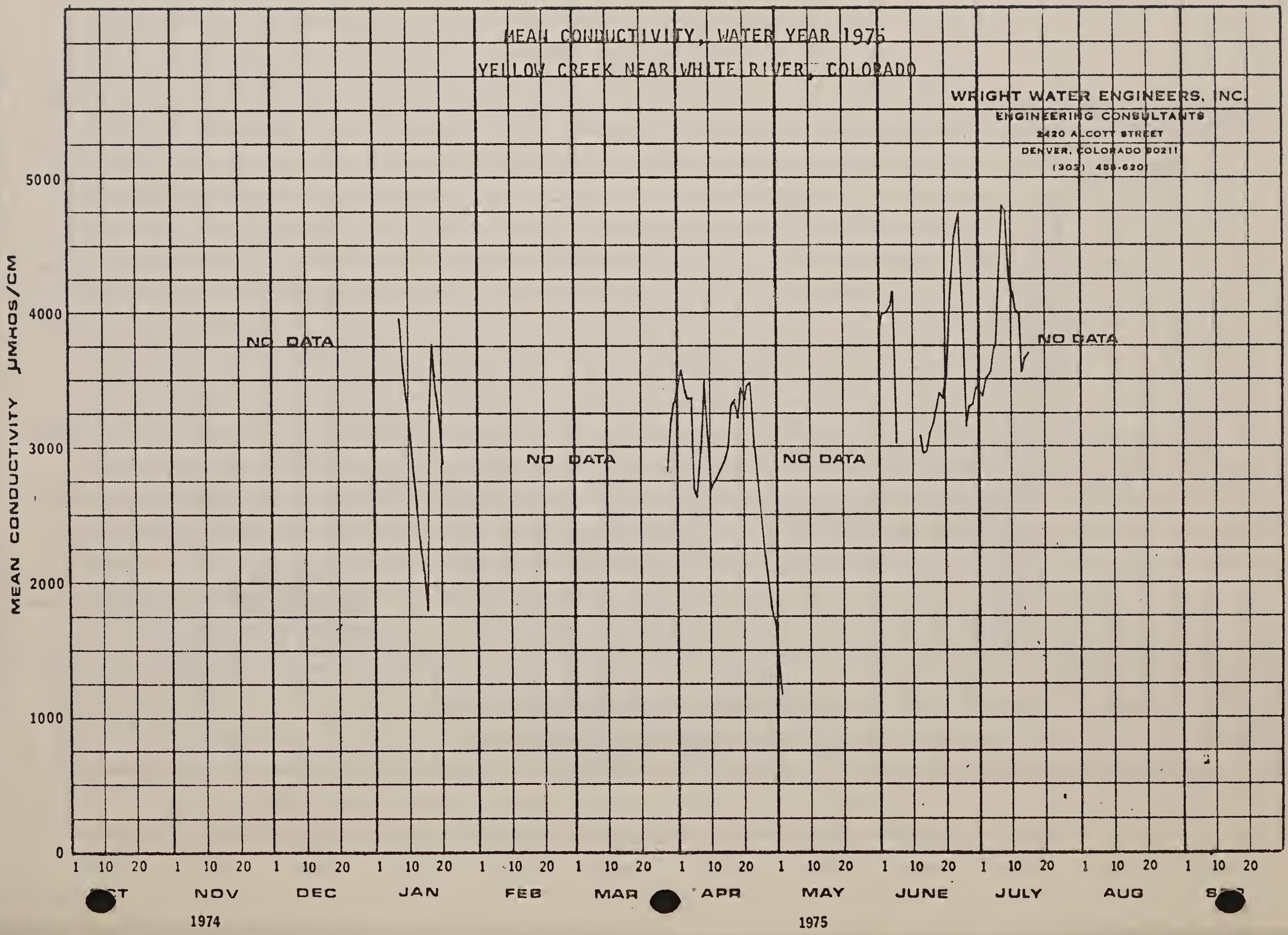

MEAN CONDUCTIVITY, WATER YEAR 1975
YELLOW CREEK NEAR WHITE RIVER, COLORADO
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-620
MEAN CONDUCTIVITY µMHOS/CM
5000
4000
3000
2000
1000
0
NO DATA
NO DATA
NO DATA
NO DATA
1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20
CT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
S
1974
1975

Figure 1.2-16

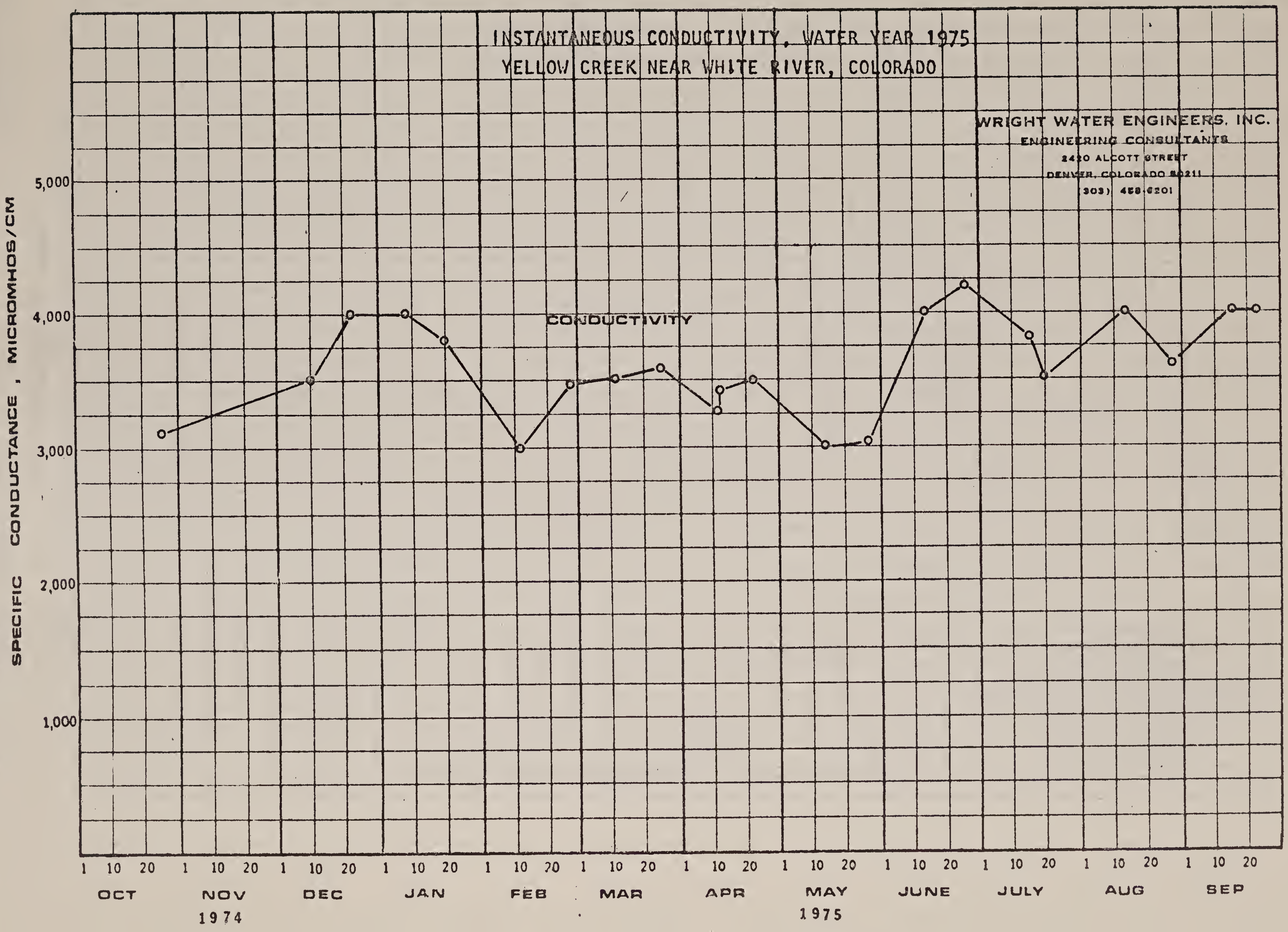


FIGURE 1.2-16a

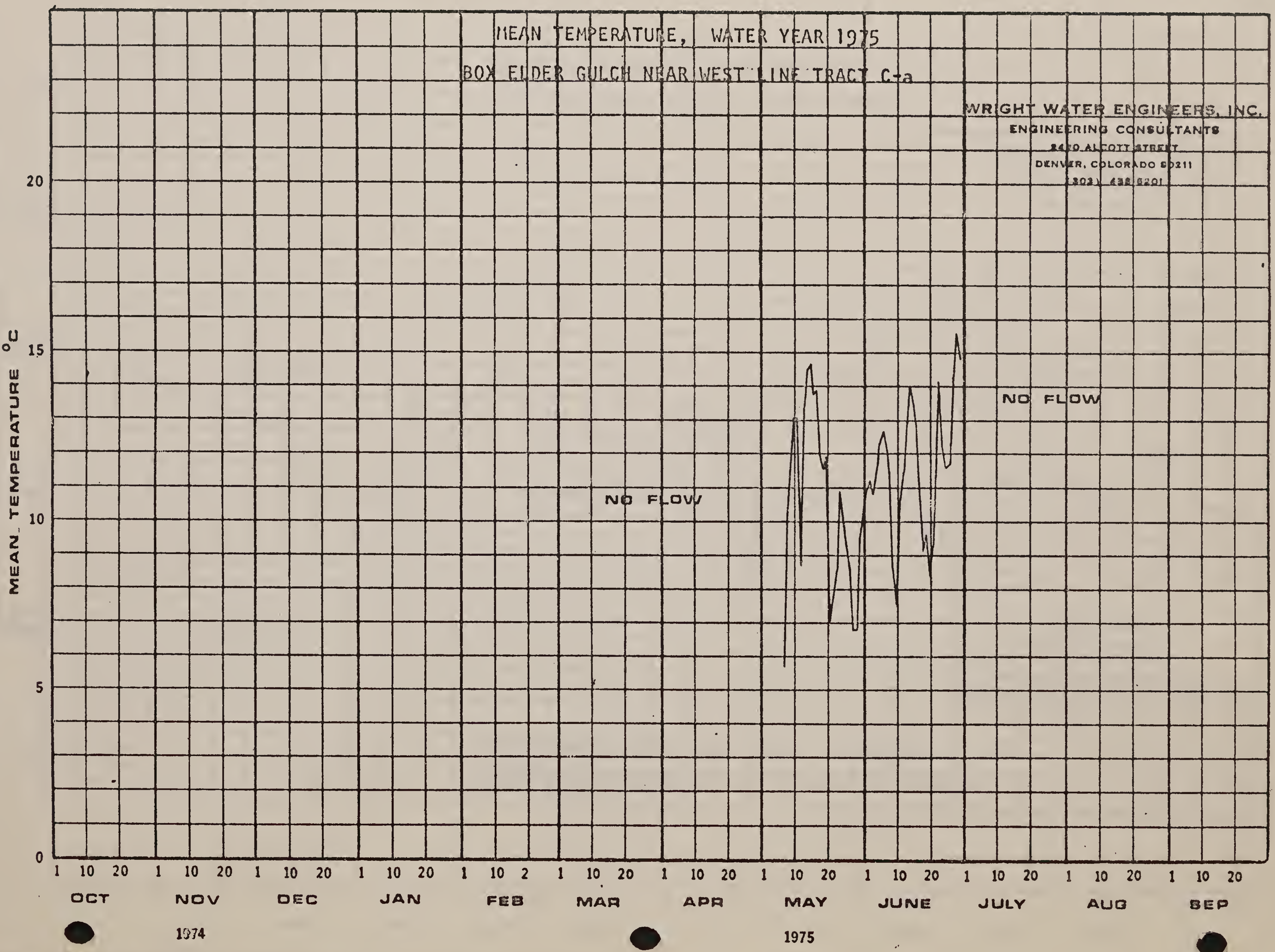

MEAN TEMPERATURE, WATER YEAR 1975
BOX ELDER GULCH NEAR WEST LINE TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MEAN TEMPERATURE °C
0
5
10
15
20
NO FLOW
NO FLOW
1
10
20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1974
1975

Figure 1.2-17

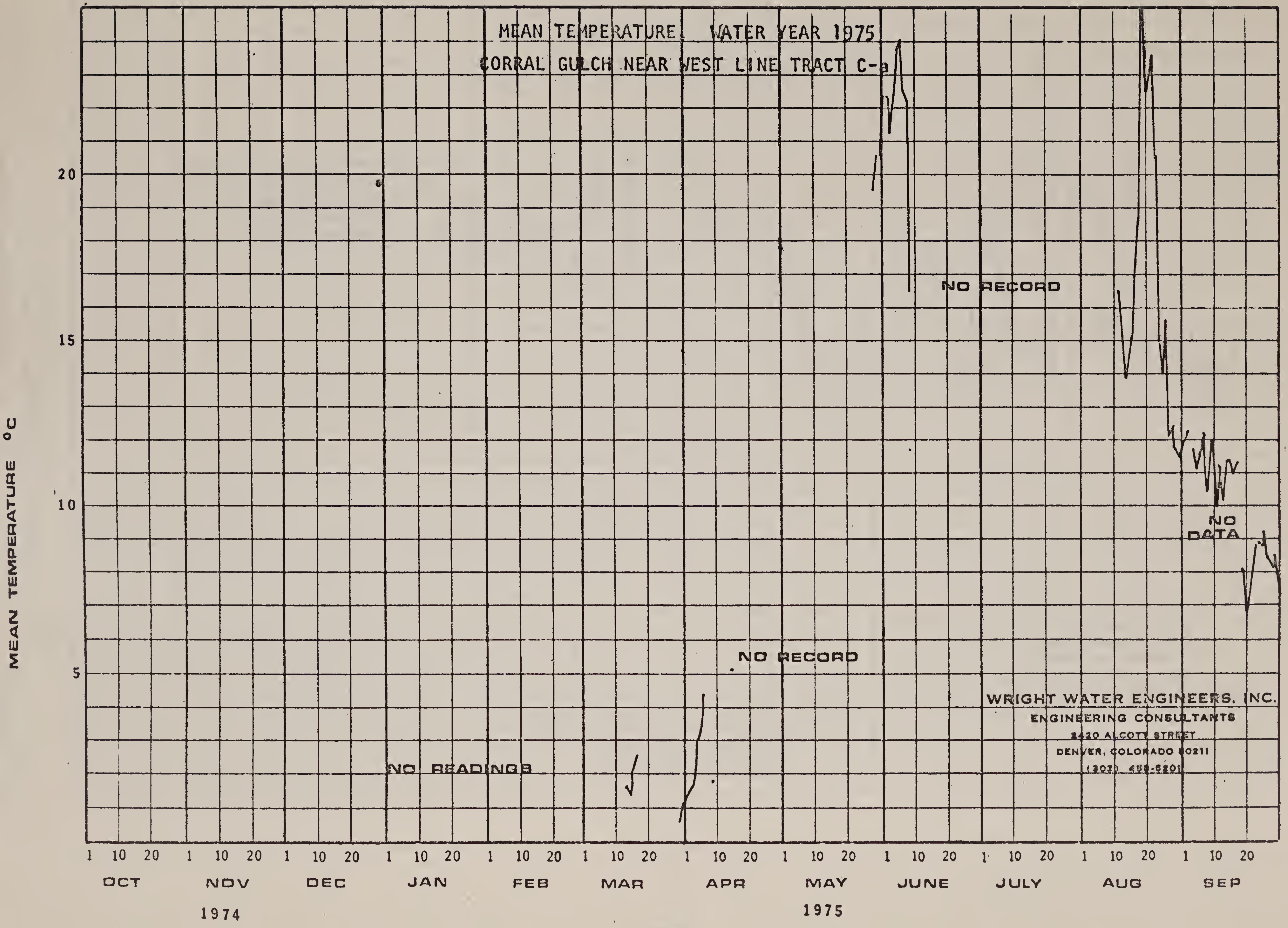

MEAN TEMPERATURE WATER YEAR 1975
CORRAL GULCH NEAR WEST LINE TRACT C-a
MEAN TEMPERATURE °C
20
15
10
5
NO READINGS
NO RECORD
NO RECORD
NO DATA
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1974
1975

Figure 1.2-18

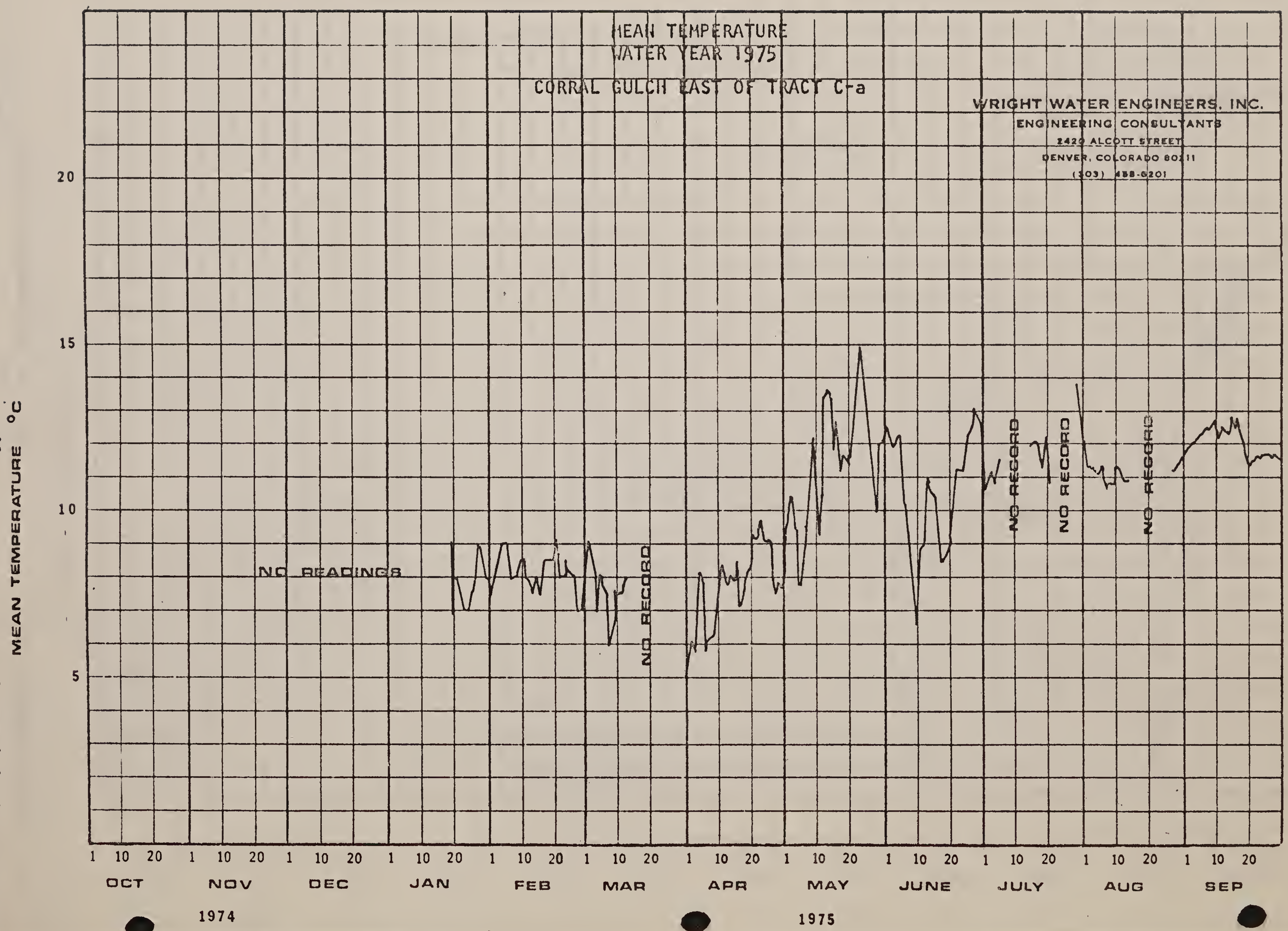

MEAN TEMPERATURE
WATER YEAR 1975
CORRAL GULCH EAST OF TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MEAN TEMPERATURE °C
20
15
10
5
NO READINGS
NO RECORD
NO RECORD
NO RECORD
NO RECORD
1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1974
1975

Figure 1.2-19

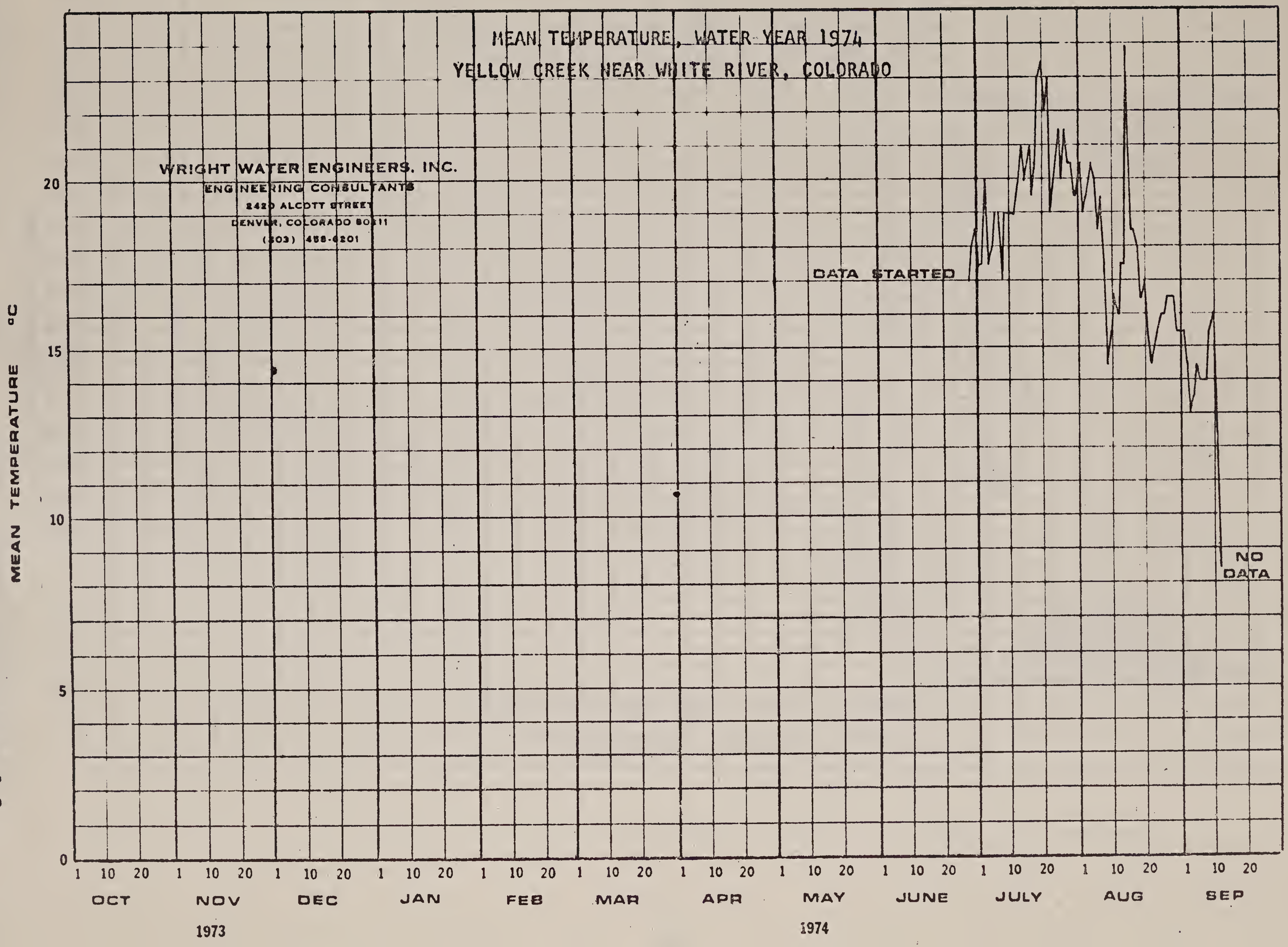

MEAN TEMPERATURE, WATER YEAR 1974
YELLOW CREEK NEAR WHITE RIVER, COLORADO

Figure 1.2-20

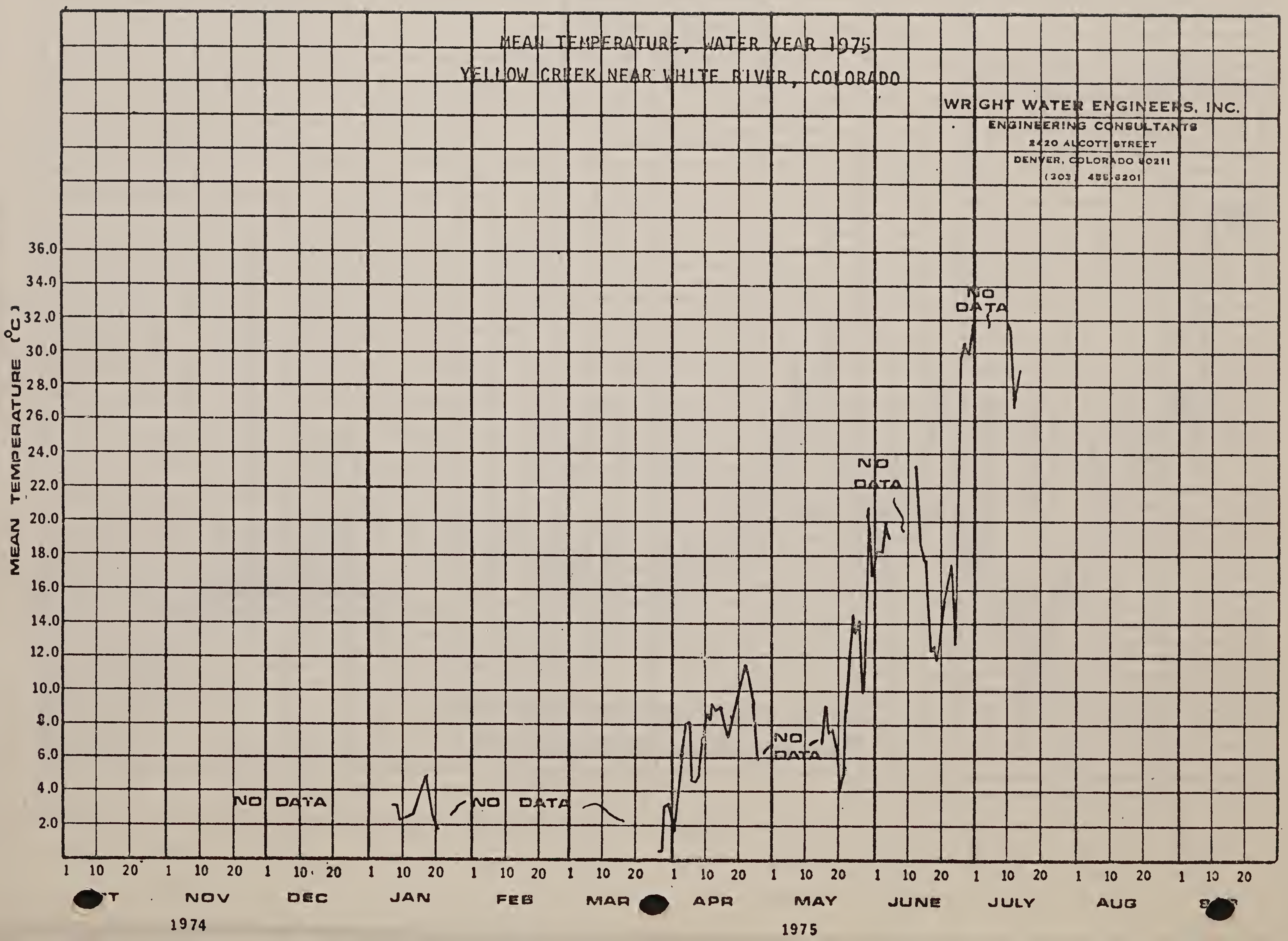

MEAN TEMPERATURE, WATER YEAR 1975
YELLOW CREEK NEAR WHITE RIVER, COLORADO
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MEAN TEMPERATURE (°C)
36.0
34.0
32.0
30.0
28.0
26.0
24.0
22.0
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
NO DATA
NO DATA
NO DATA
NO DATA
NO DATA
1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1974
1975

Figure 1.2-21

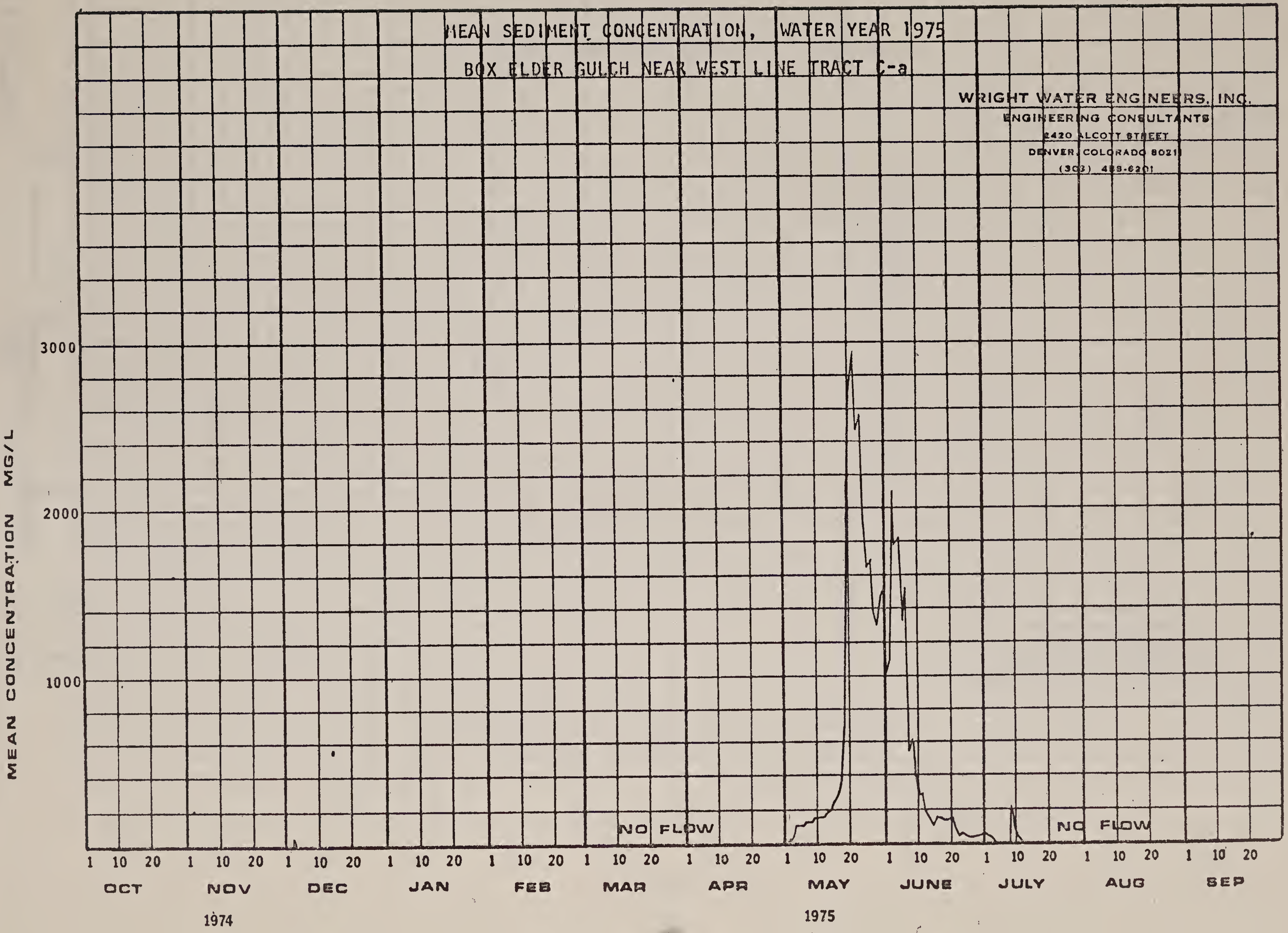

MEAN SEDIMENT CONCENTRATION, WATER YEAR 1975
BOX ELDER GULCH NEAR WEST LINE TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MEAN CONCENTRATION MG/L
3000
2000
1000
NO FLOW
NO FLOW
1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1974
1975

Figure 1.2-22

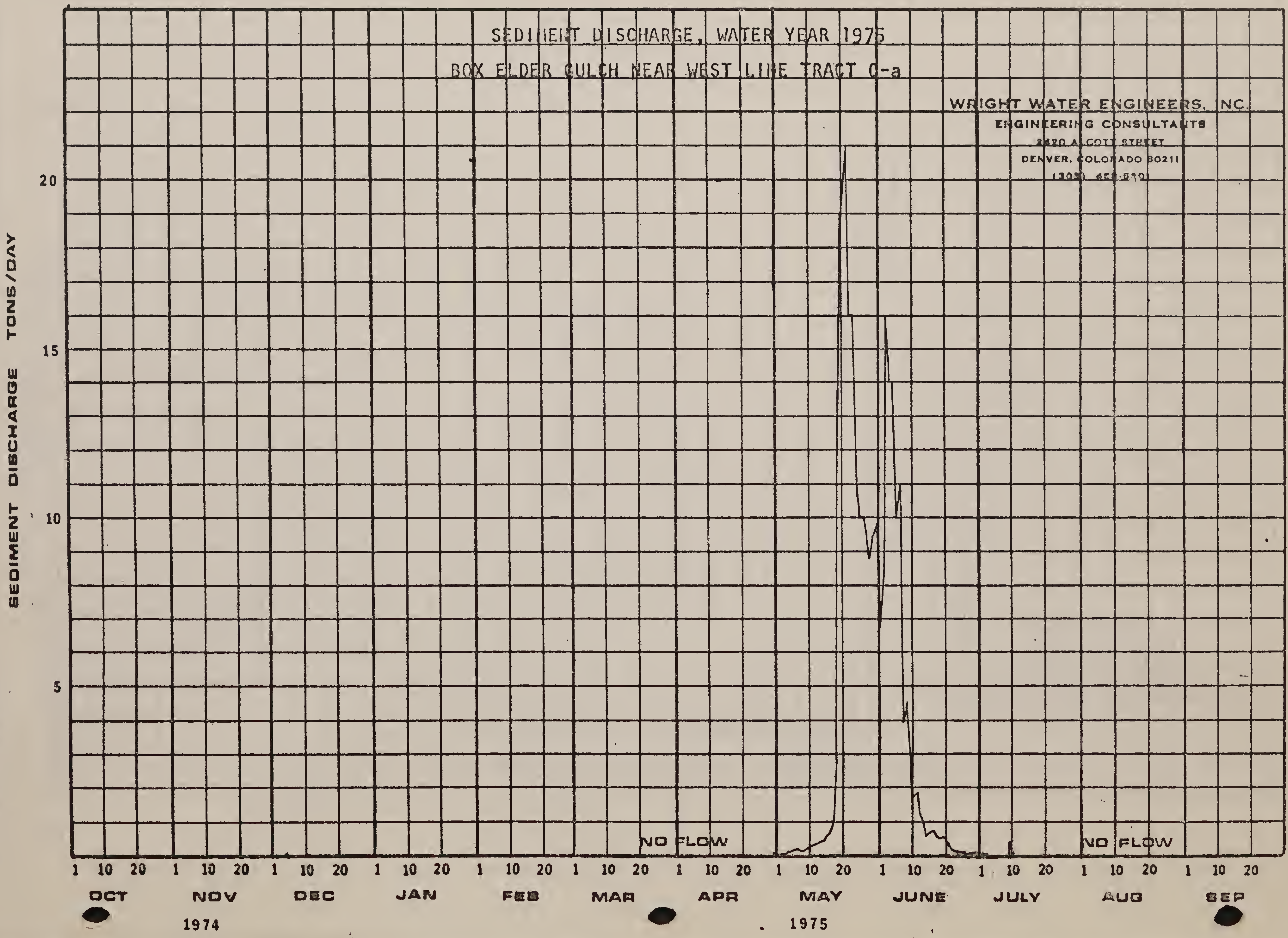

SEDIMENT DISCHARGE, WATER YEAR 1975
BOX ELDER GULCH NEAR WEST LINE TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
SEDIMENT DISCHARGE TONS/DAY
20
15
10
5
NO FLOW
NO FLOW
1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1974
1975

Figure 1.2-23

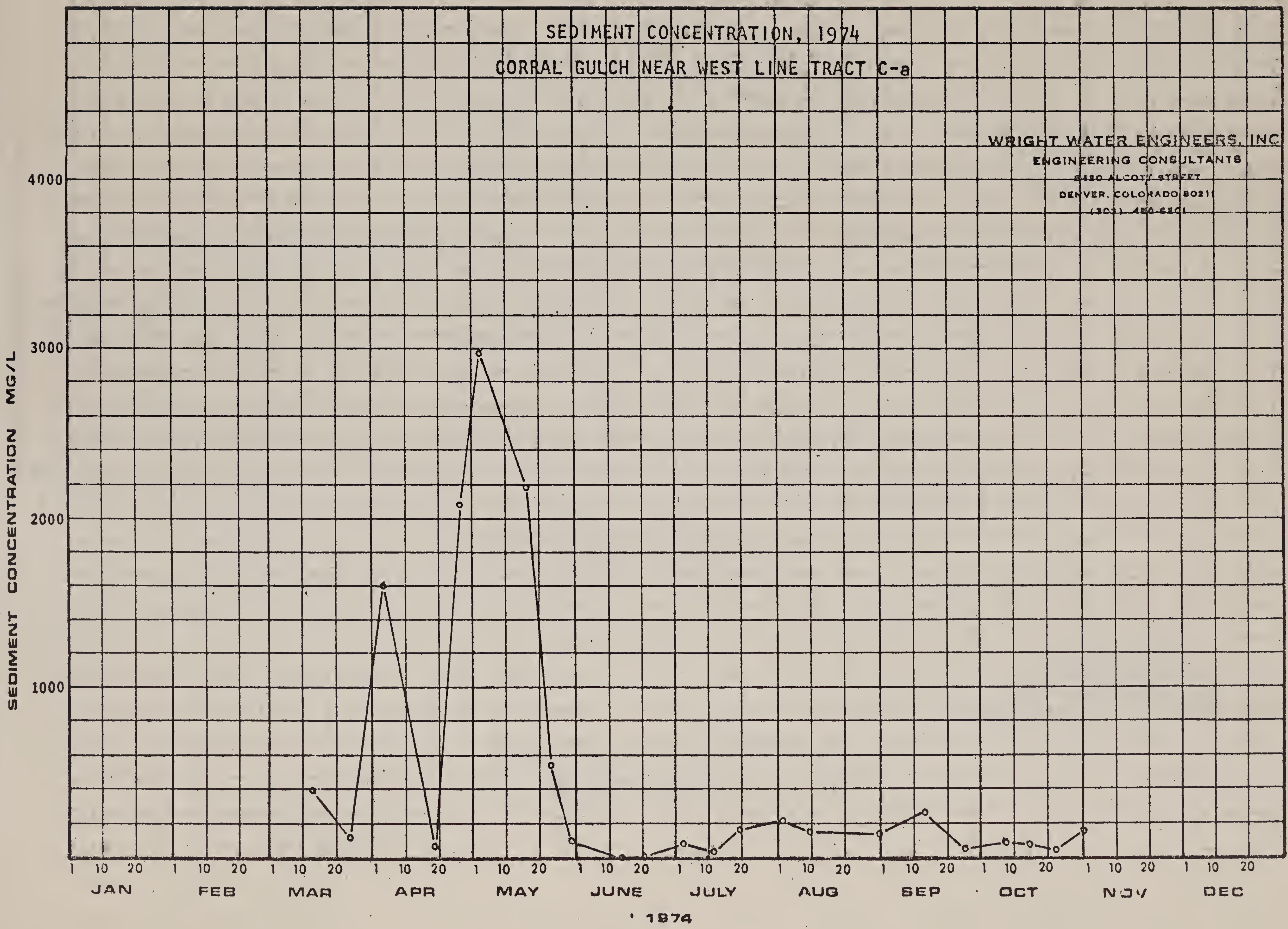

SEDIMENT CONCENTRATION, 1974
CORRAL GULCH NEAR WEST LINE TRACT C-a
WRIGHT WATER ENGINEERS, INC
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 480-6201
SEDIMENT CONCENTRATION MG/L
4000
3000
2000
1000
1 10 20
JAN
1 10 20
FEB
1 10 20
MAR
1 10 20
APR
1 10 20
MAY
1 10 20
JUNE
1 10 20
JULY
1 10 20
AUG
1 10 20
SEP
1 10 20
OCT
1 10 20
NOV
1 10 20
DEC
1974

Figure 1.2-24

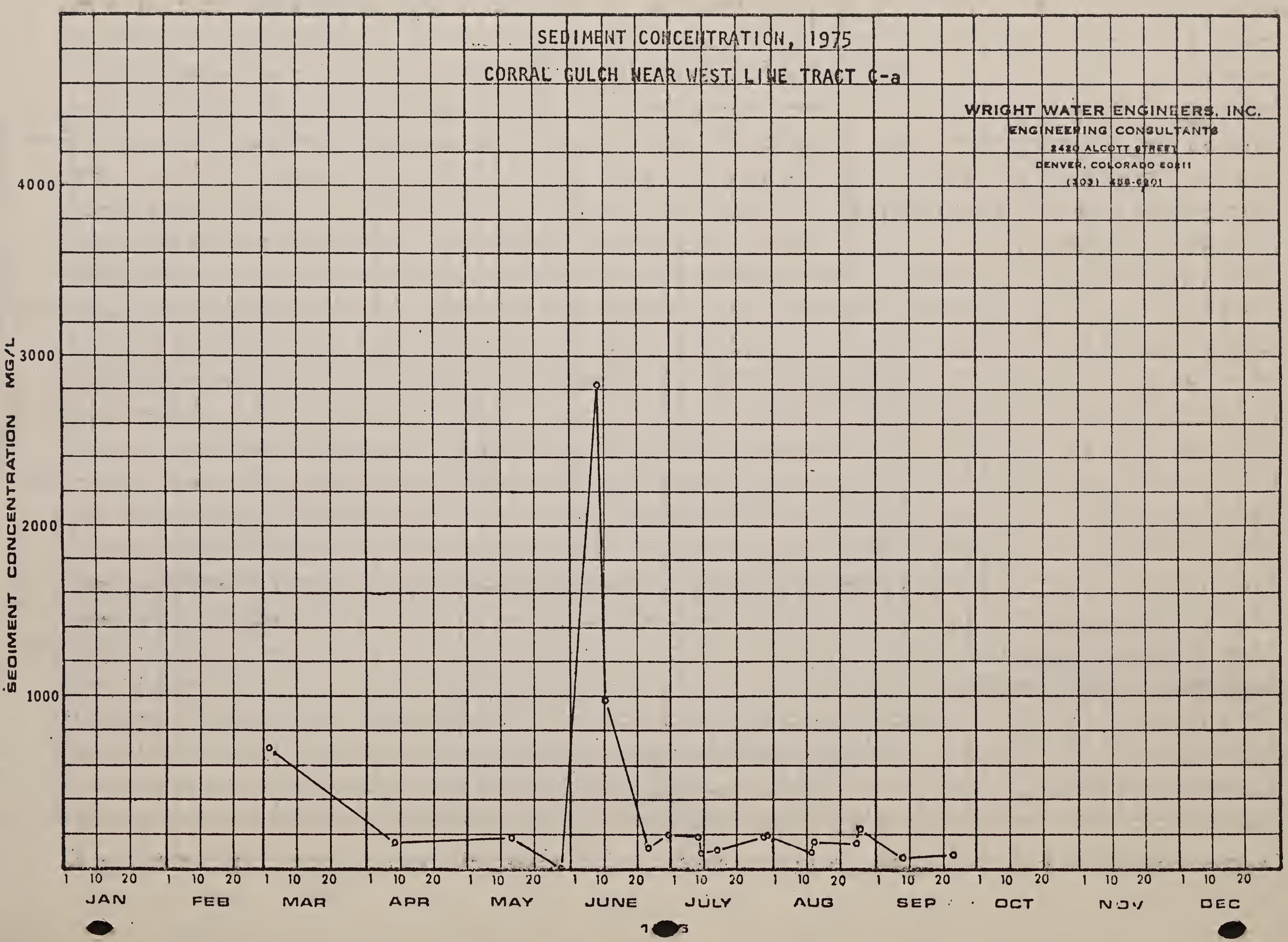

SEDIMENT CONCENTRATION, 1975
CORRAL GULCH NEAR WEST LINE TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
SEDIMENT CONCENTRATION MG/L
4000
3000
2000
1000
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1975

Figure 1.2-25

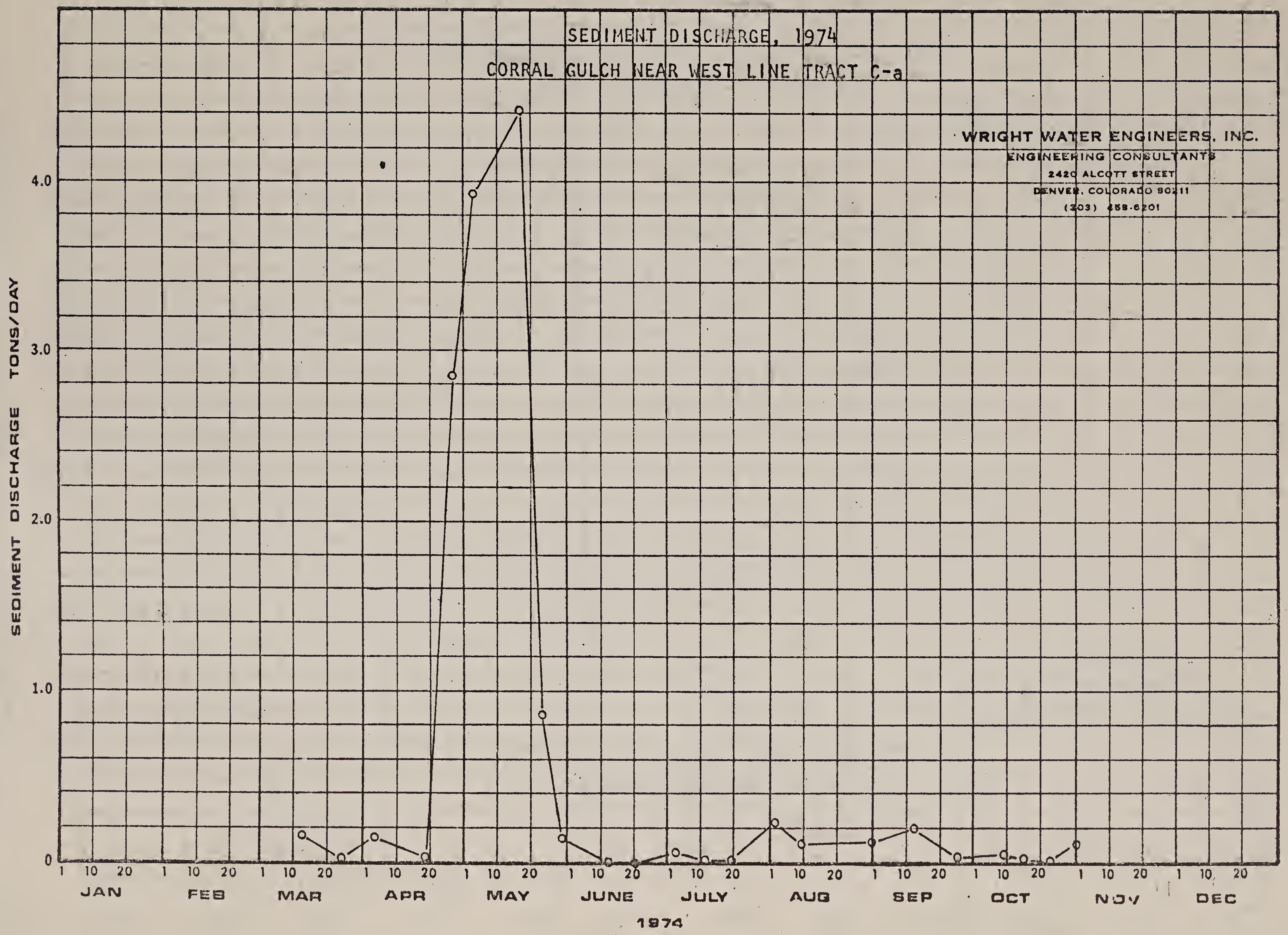

SEDIMENT DISCHARGE, 1974
CORRAL GULCH NEAR WEST LINE TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
SEDIMENT DISCHARGE TONS/DAY
4.0
3.0
2.0
1.0
0
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1974

Figure 1.2-26

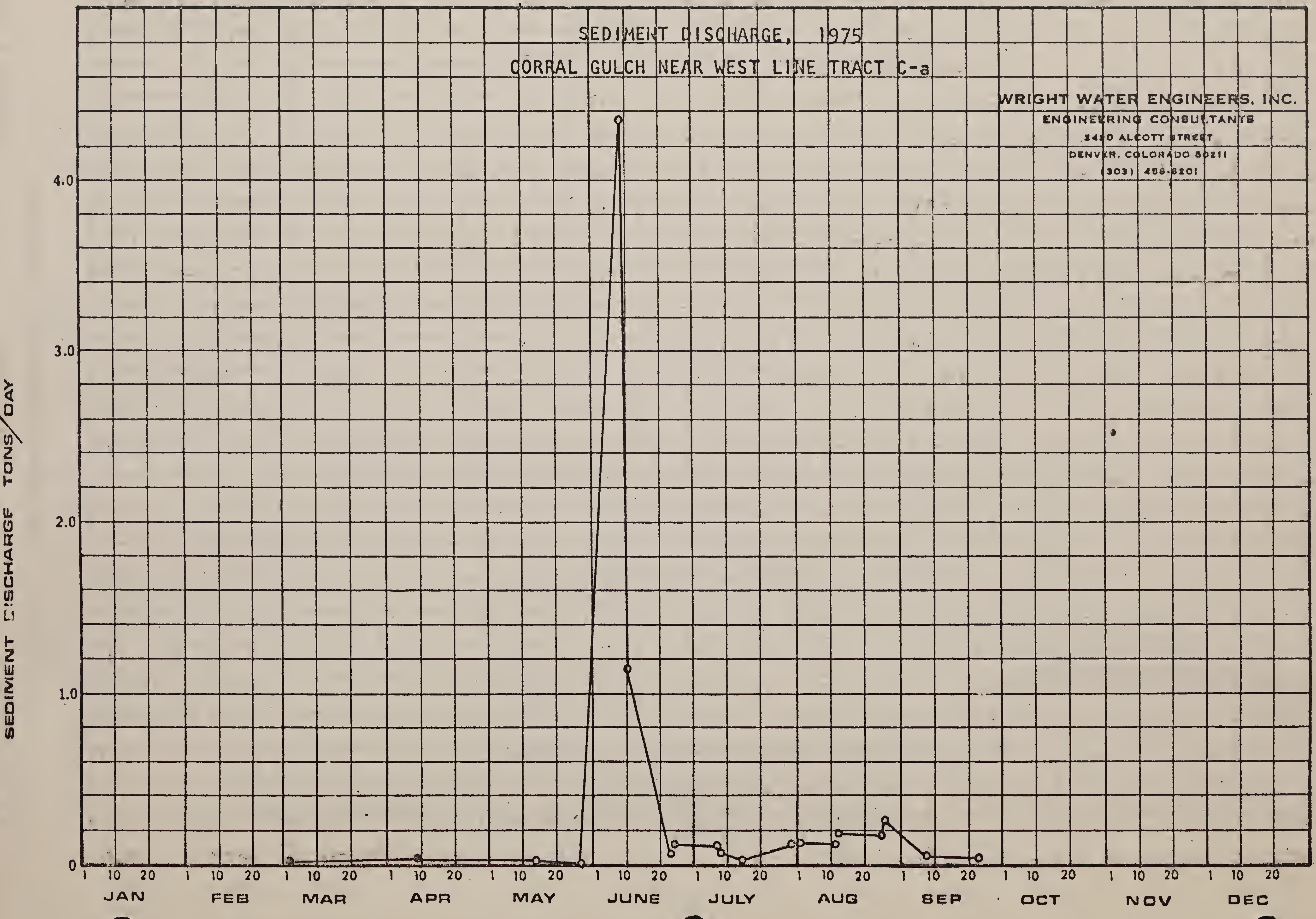

SEDIMENT DISCHARGE, 1975
CORRAL GULCH NEAR WEST LINE TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
SEDIMENT DISCHARGE TONS/DAY
4.0
3.0
2.0
1.0
0
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC

Figure 1.2-27

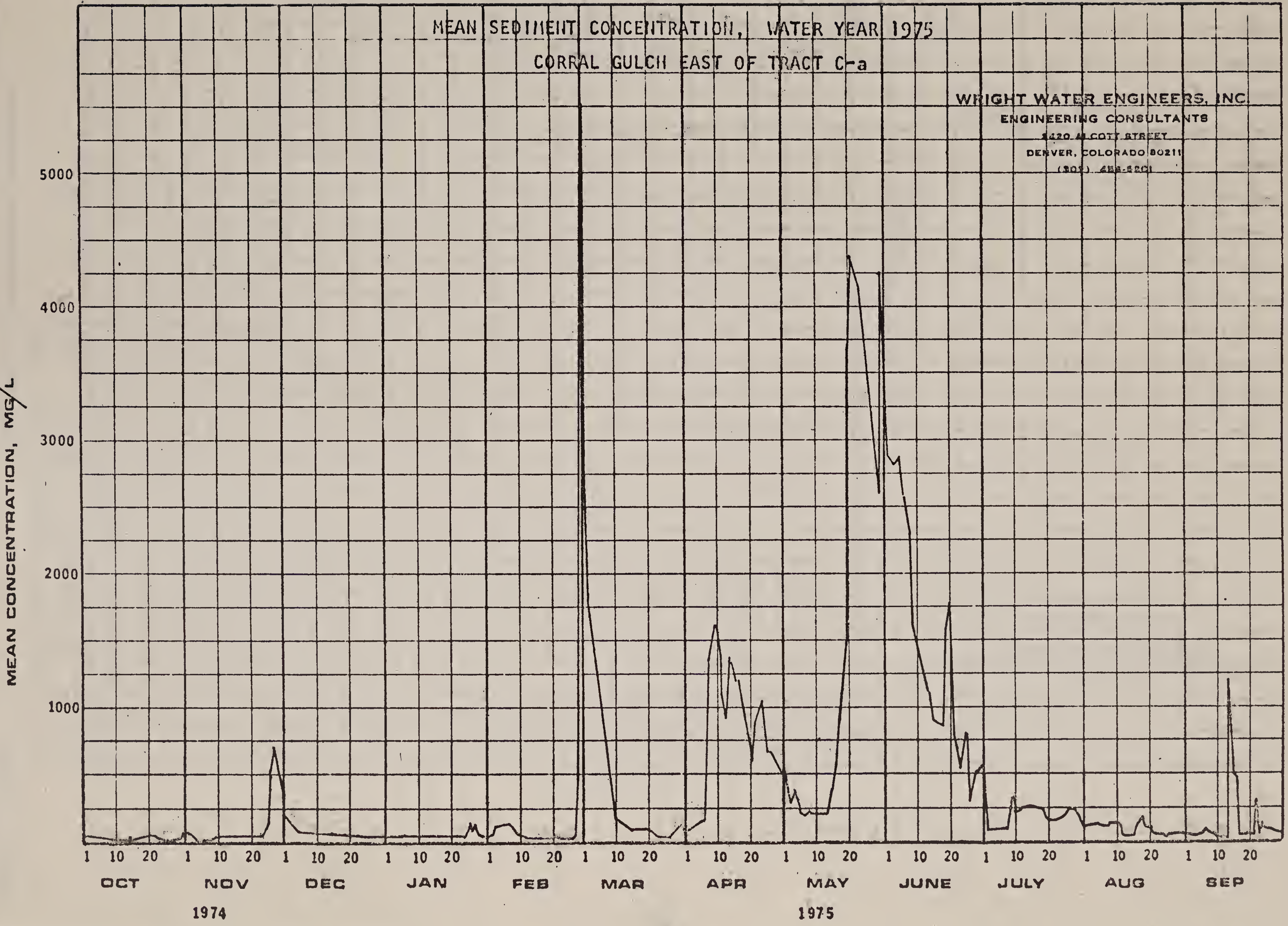

MEAN SEDIMENT CONCENTRATION, WATER YEAR 1975
CORRAL GULCH EAST OF TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MEAN CONCENTRATION, MG/L
5000
4000
3000
2000
1000
1
10
20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1974
1975

Figure 1.2-28

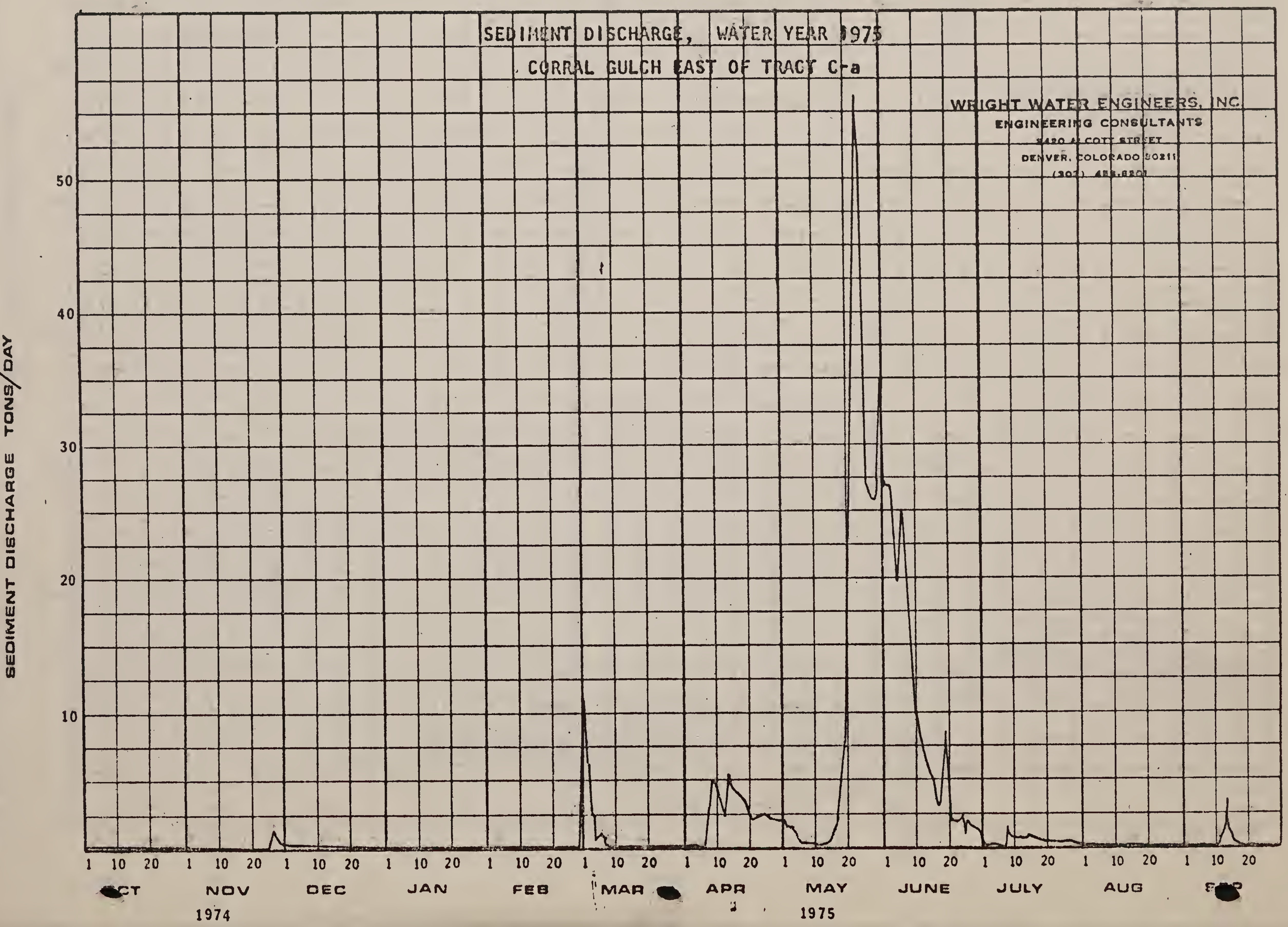

SEDIMENT DISCHARGE, WATER YEAR 1975
CORRAL GULCH EAST OF TRACY C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
SEDIMENT DISCHARGE TONS/DAY
10
20
30
40
50
1 10 20
OCT
NOV
1974
DEC
JAN
FEB
MAR
APR
MAY
1975
JUNE
JULY
AUG
SEP

Figure 1.2-29

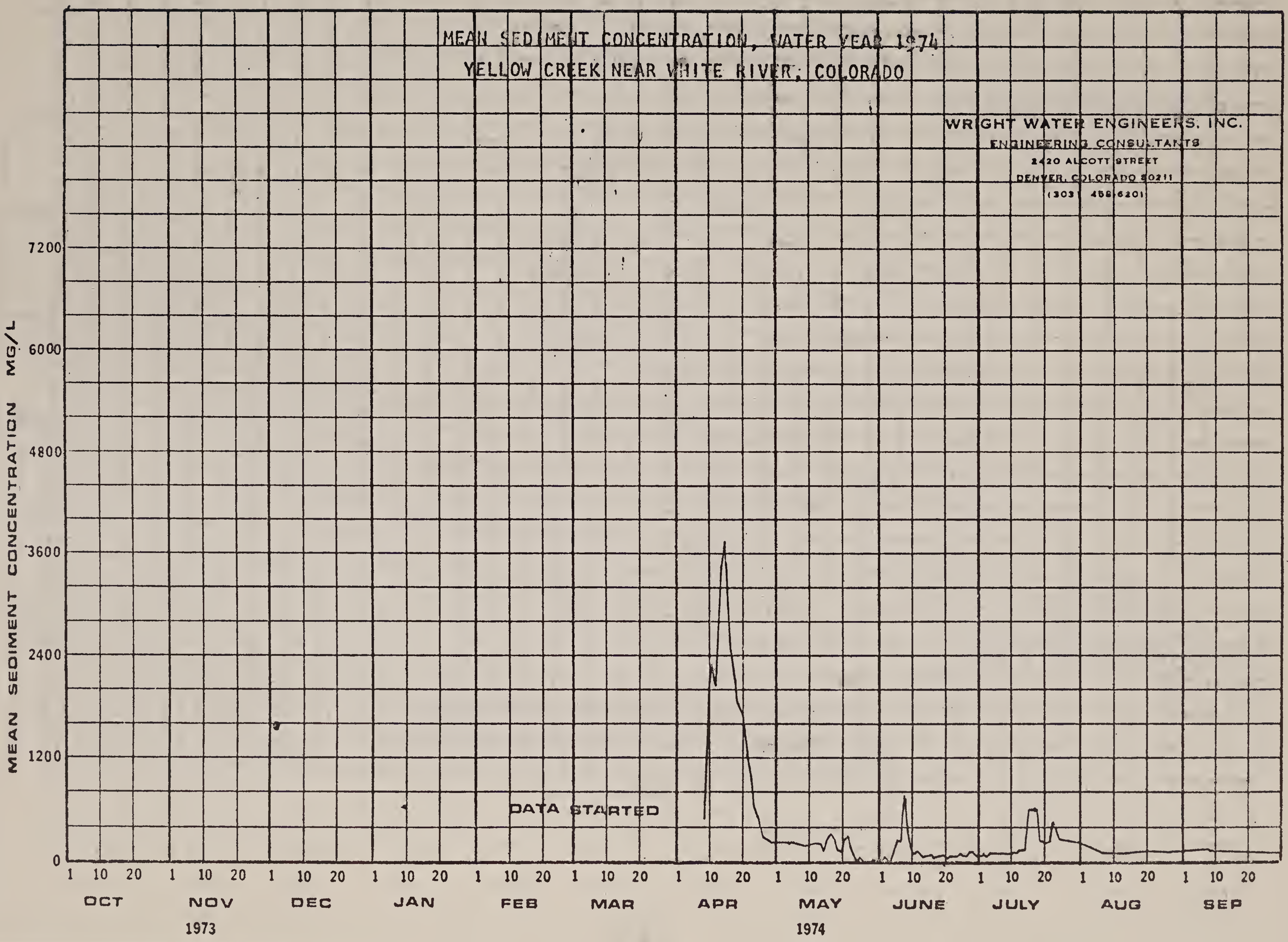

MEAN SEDIMENT CONCENTRATION, WATER YEAR 1974
YELLOW CREEK NEAR WHITE RIVER, COLORADO
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MEAN SEDIMENT CONCENTRATION MG/L
7200
6000
4800
3600
2400
1200
0
DATA STARTED
1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1973
1974

Figure 1.2-30

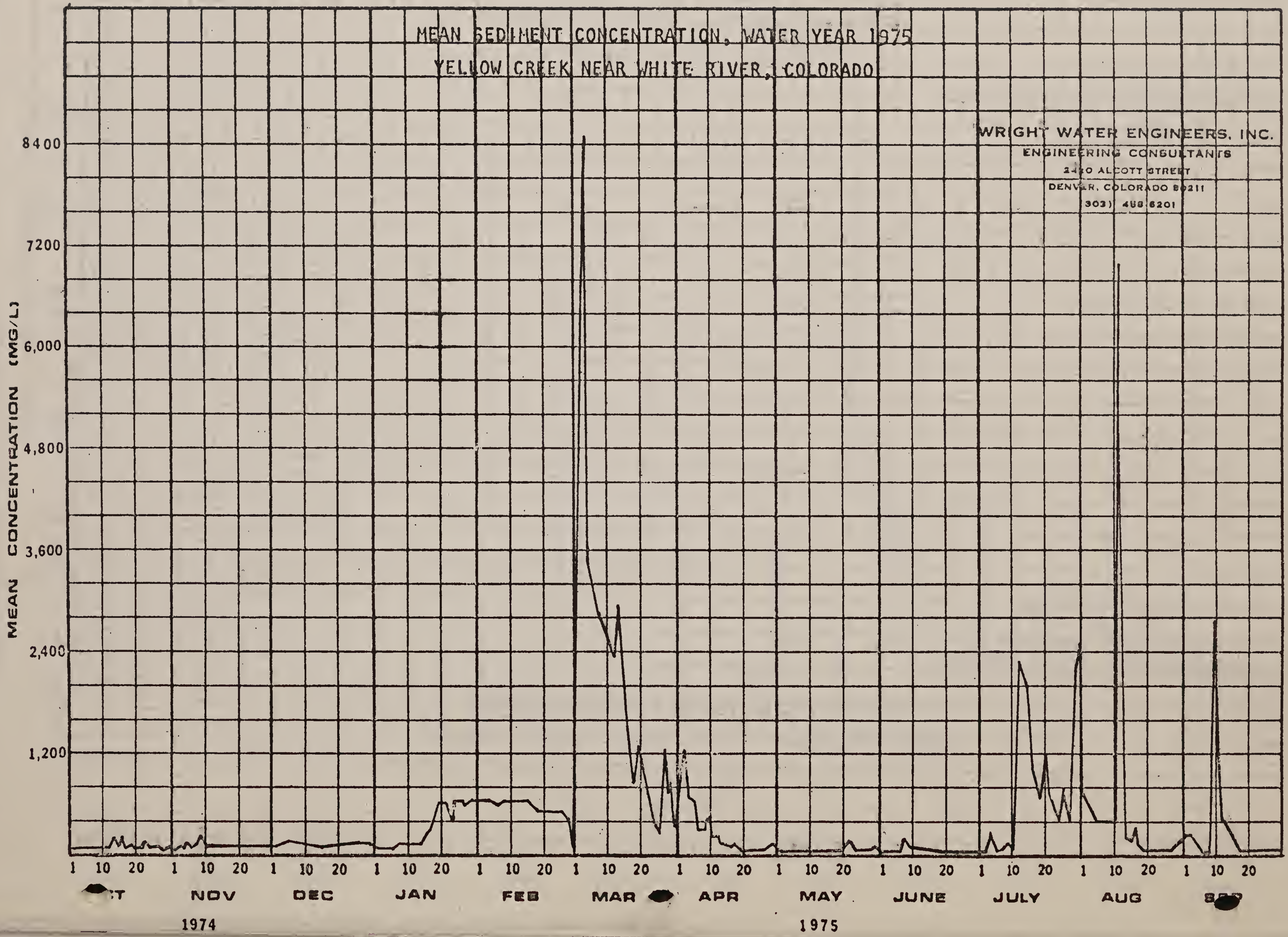

MEAN SEDIMENT CONCENTRATION, WATER YEAR 1975
YELLOW CREEK NEAR WHITE RIVER, COLORADO
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MEAN CONCENTRATION (MG/L)
8400
7200
6,000
4,800
3,600
2,400
1,200
1 10 20
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
1974
1975

Figure 1.2-31

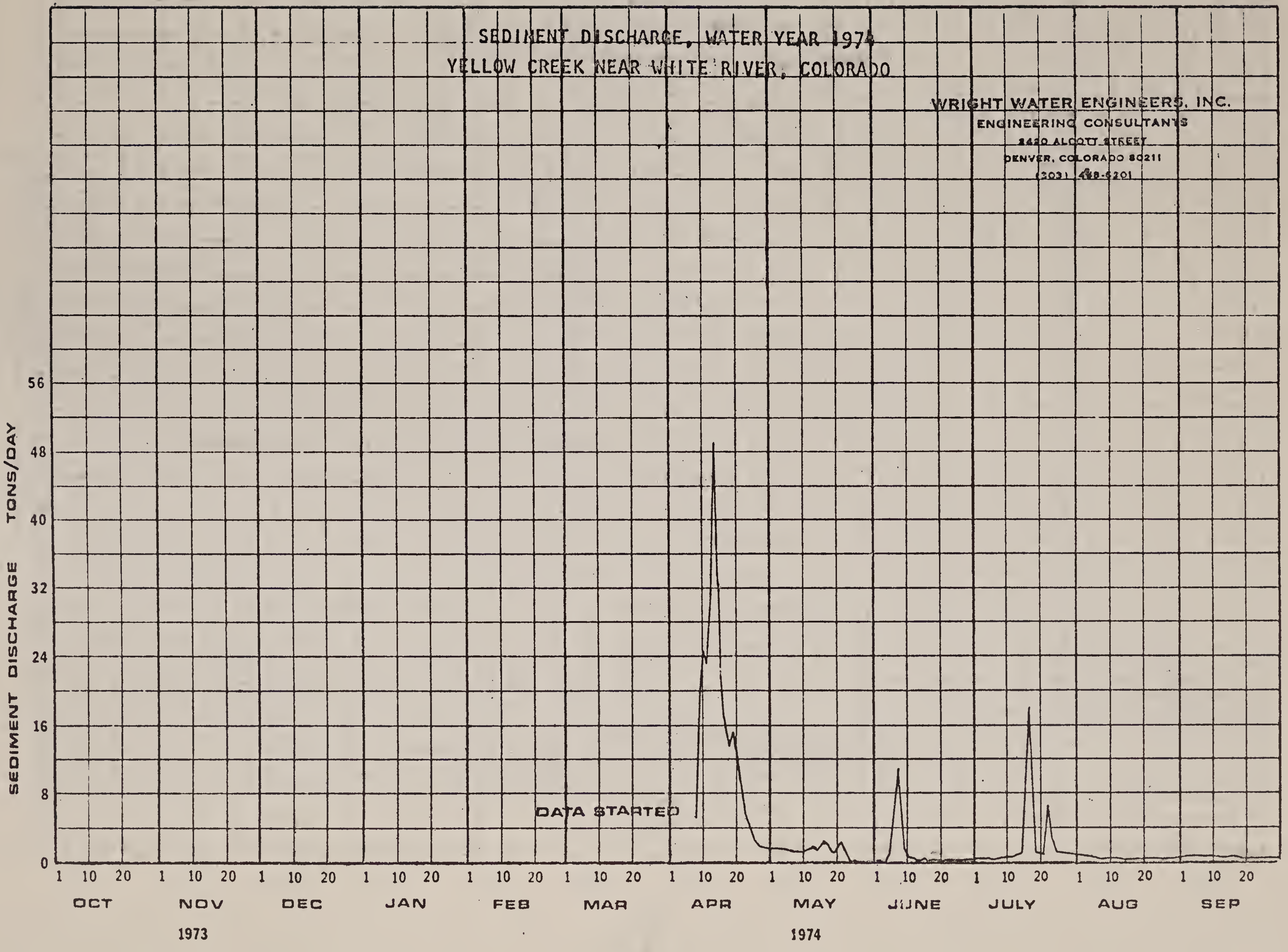

SEDIMENT DISCHARGE, WATER YEAR 1974
YELLOW CREEK NEAR WHITE RIVER, COLORADO
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
SEDIMENT DISCHARGE TONS/DAY
0
8
16
24
32
40
48
56
DATA STARTED
1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1973
1974

Figure 1.2-32

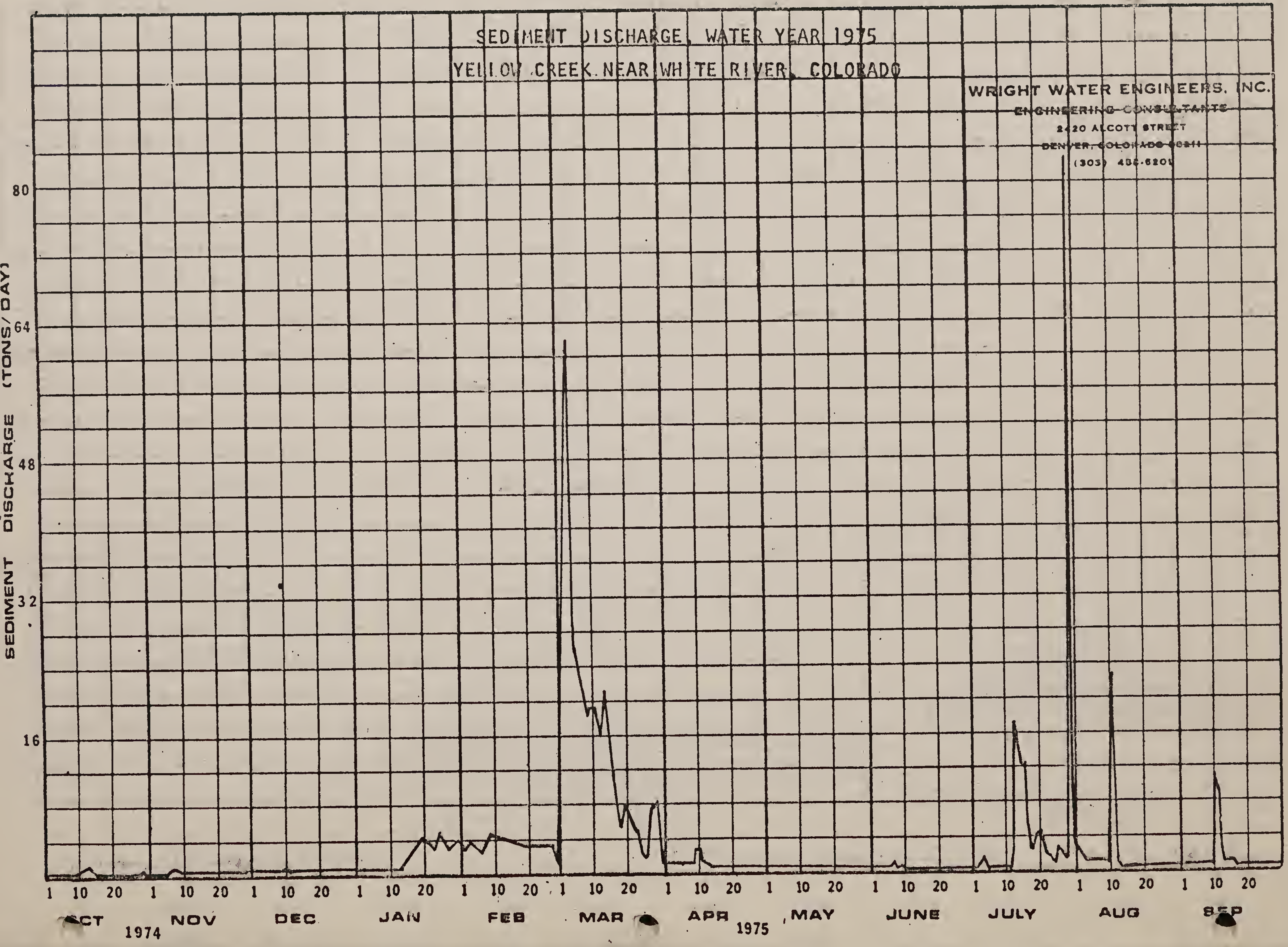

SEDIMENT DISCHARGE, WATER YEAR 1975
YELLOW CREEK NEAR WHITE RIVER, COLORADO
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 480-6201
SEDIMENT DISCHARGE (TONS/ DAY)
80
64
48
32
16
1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
1974
1975

Figure 1.2-33

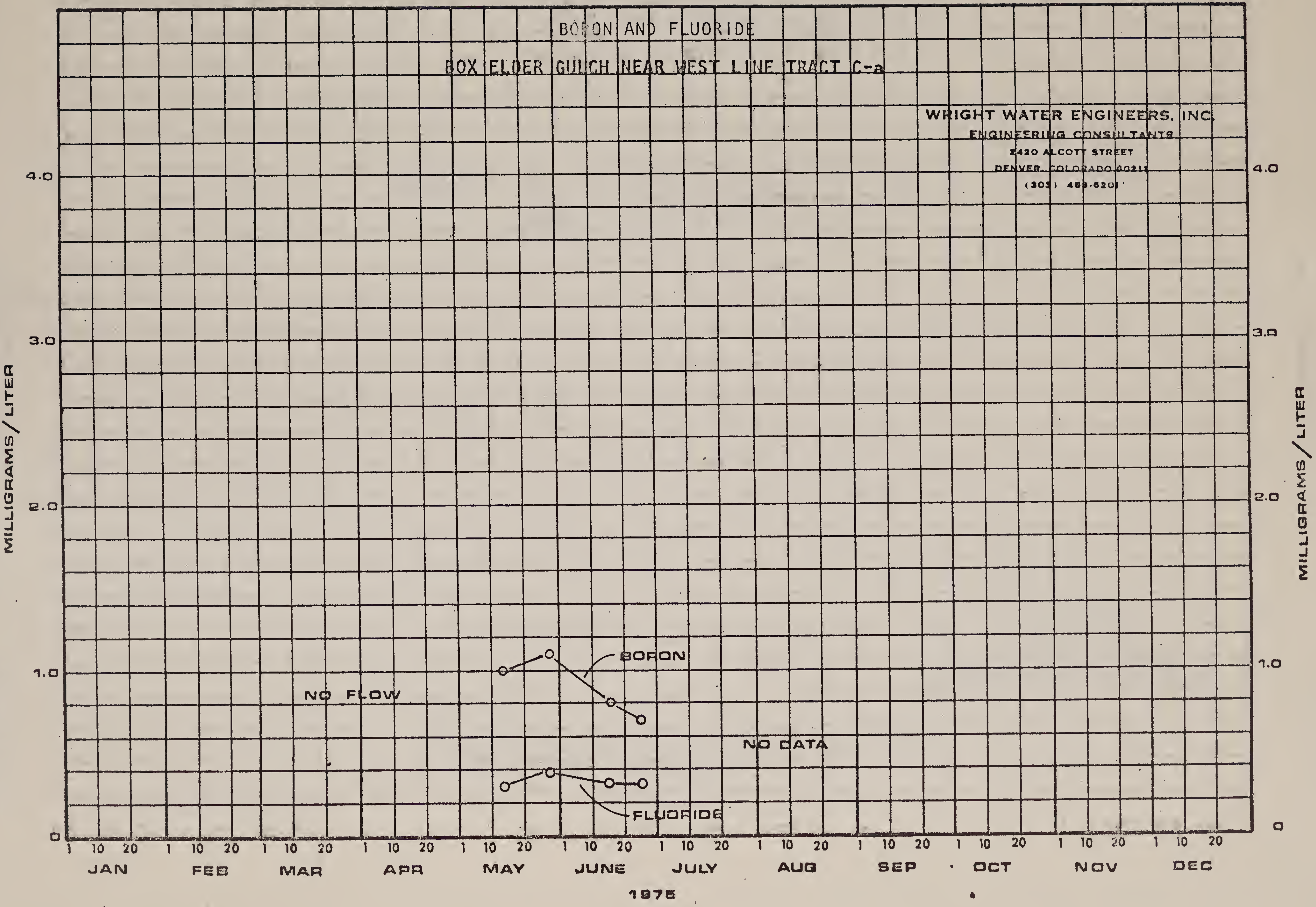

BORON AND FLUORIDE
BOX ELDER GULCH NEAR WEST LINE TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MILLIGRAMS/LITER
4.0
3.0
2.0
1.0
0
NO FLOW
BORON
FLUORIDE
NO DATA
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1975

Figure 1.2-34

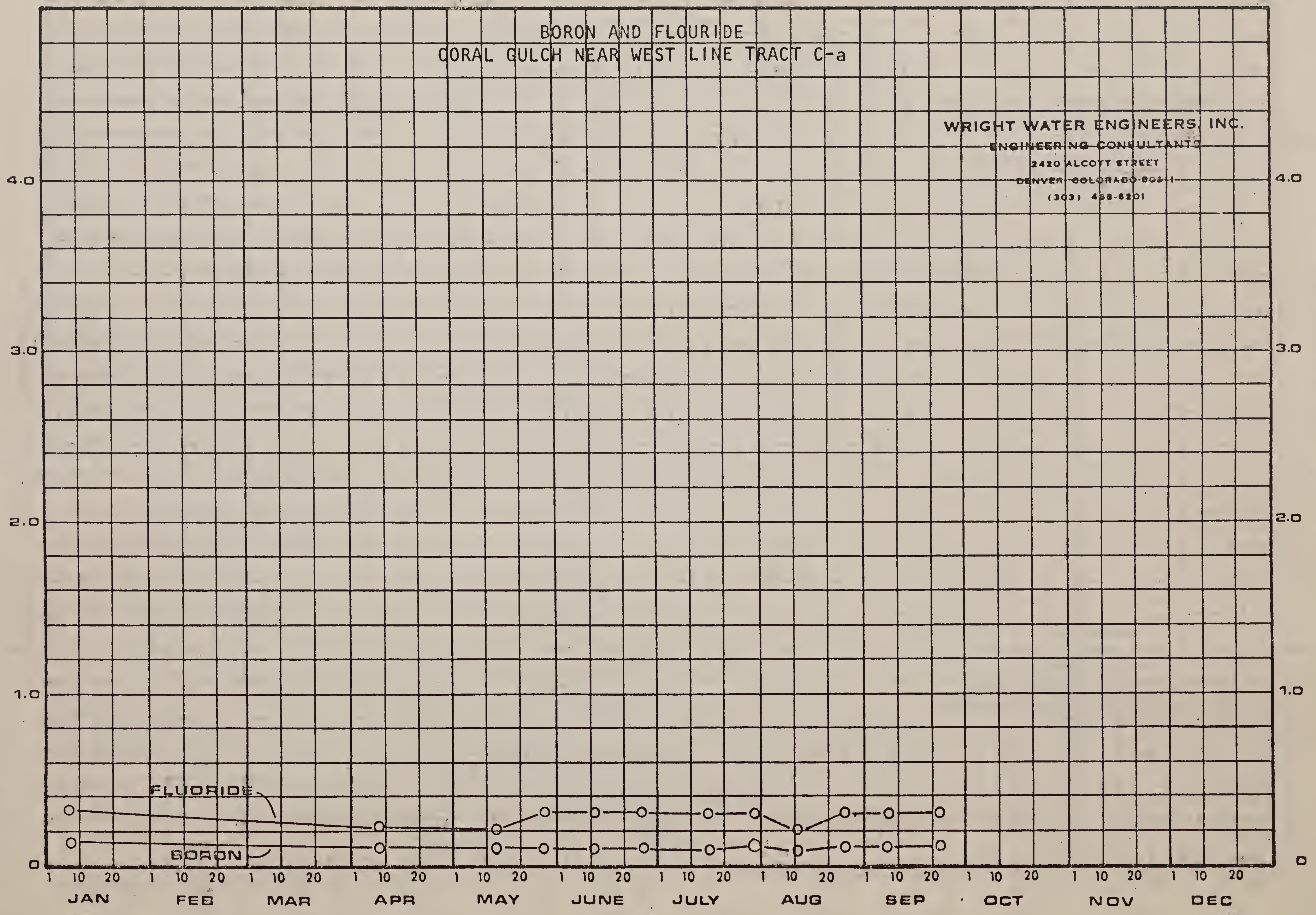

BORON AND FLOURIDE
CORAL GULCH NEAR WEST LINE TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MILLIGRAMS/LITER
MILLIGRAMS/LITER
4.0
3.0
2.0
1.0
0
FLUORIDE
BORON
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC

Figure 1.2-35

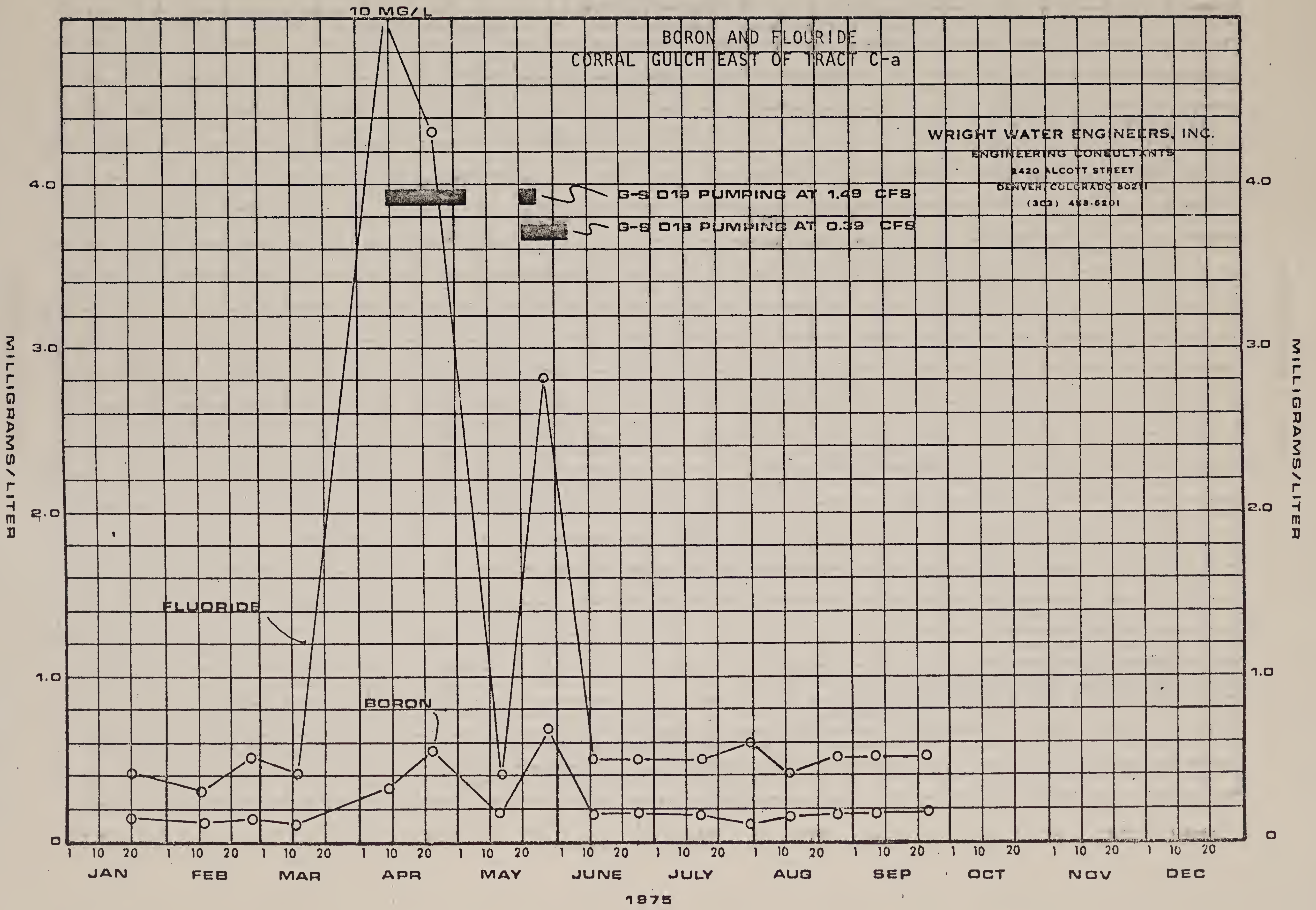

10 MG/L
BORON AND FLOURIDE
CORRAL GULCH EAST OF TRACT C-a
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
▨ G-S D13 PUMPING AT 1.49 CFS
▨ G-S D13 PUMPING AT 0.39 CFS
FLUORIDE
BORON
MILLIGRAMS/LITER
0
1.0
2.0
3.0
4.0
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1975

Figure 1.2-36

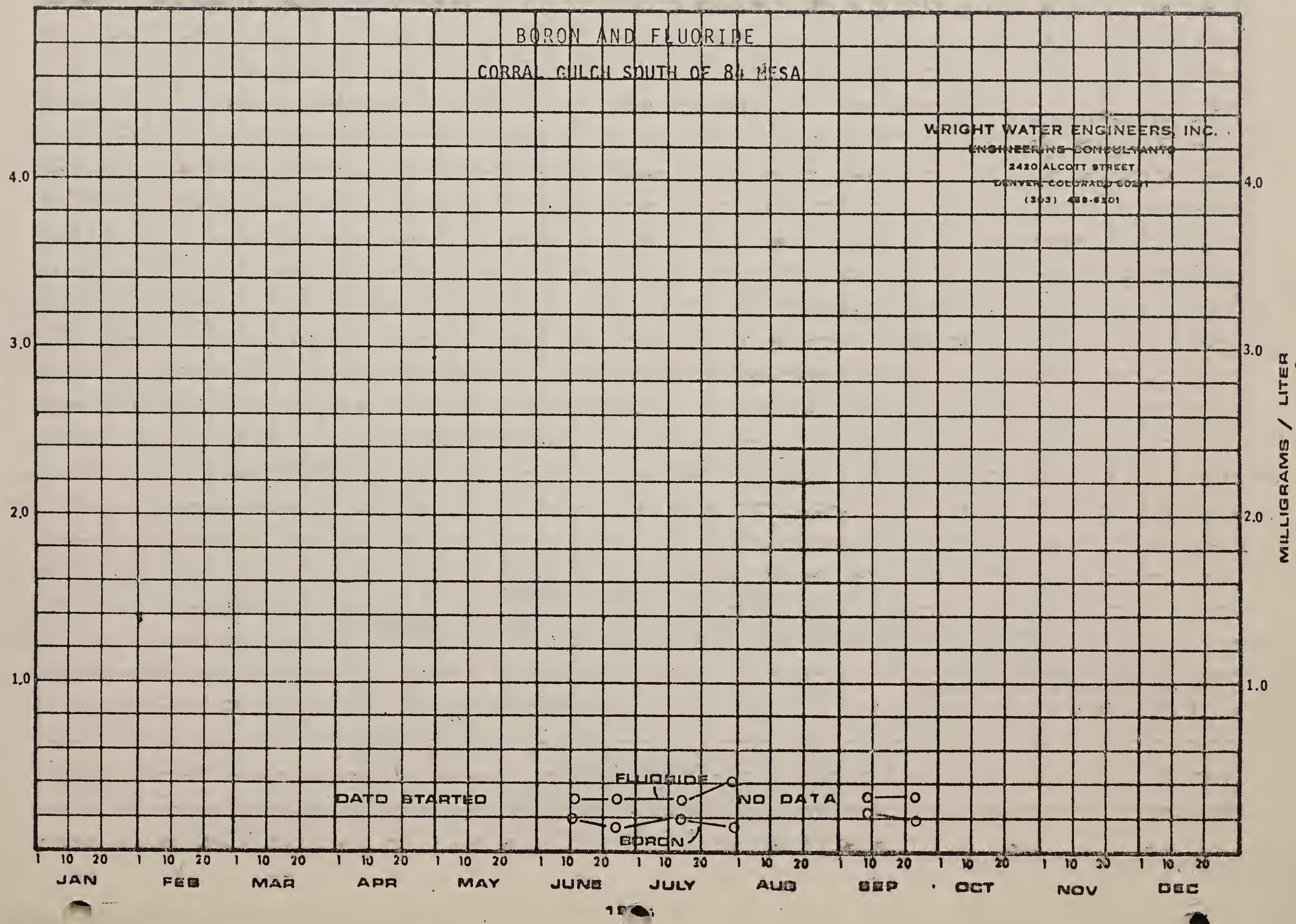

BORON AND FLUORIDE
CORRAL GULCH SOUTH OF 84 MESA
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MILLIGRAMS/ LITER
4.0
3.0
2.0
1.0
DATA STARTED
FLUORIDE
BORON
NO DATA
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
19

Figure 1.2-37

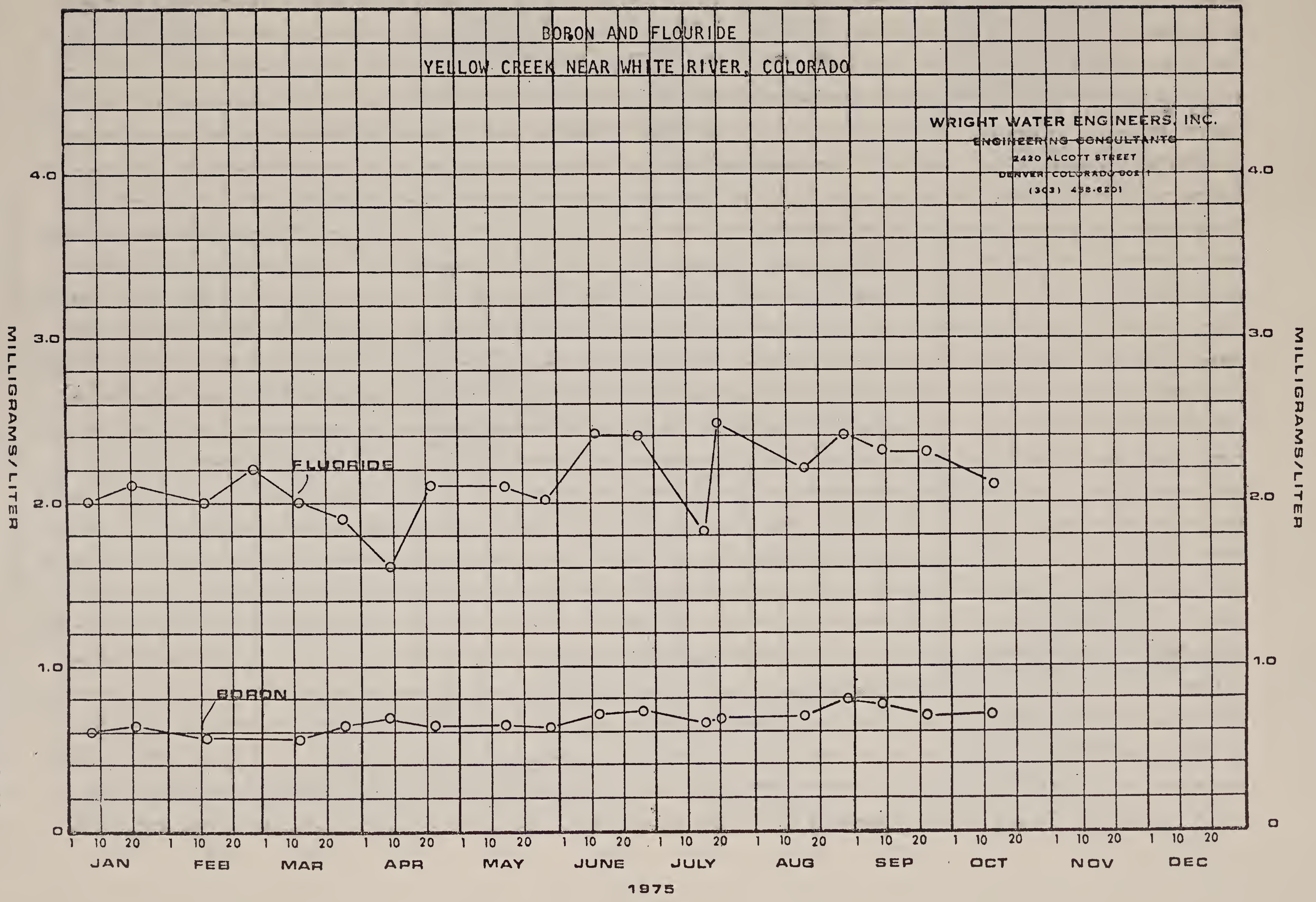

BORON AND FLOURIDE
YELLOW CREEK NEAR WHITE RIVER, COLORADO
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
MILLIGRAMS/LITER
4.0
3.0
2.0
1.0
0
FLUORIDE
BORON
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1975

Figure 1.2-38

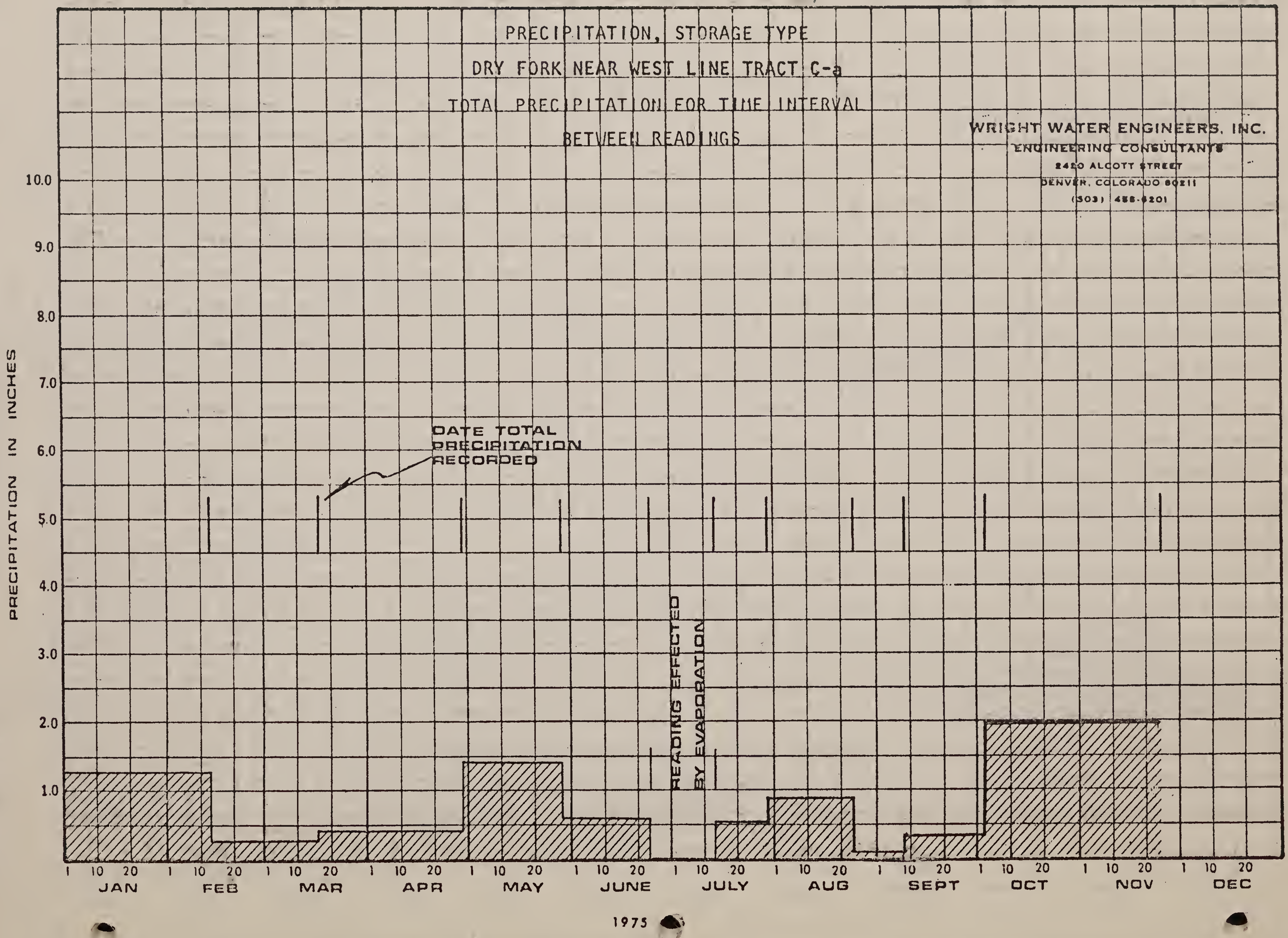

PRECIPITATION, STORAGE TYPE
DRY FORK NEAR WEST LINE TRACT C-a
TOTAL PRECIPITATION FOR TIME INTERVAL
BETWEEN READINGS
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-8201
PRECIPITATION IN INCHES
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
DATE TOTAL PRECIPITATION RECORDED
READING EFFECTED BY EVAPORATION
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1975

Figure 1.2-29

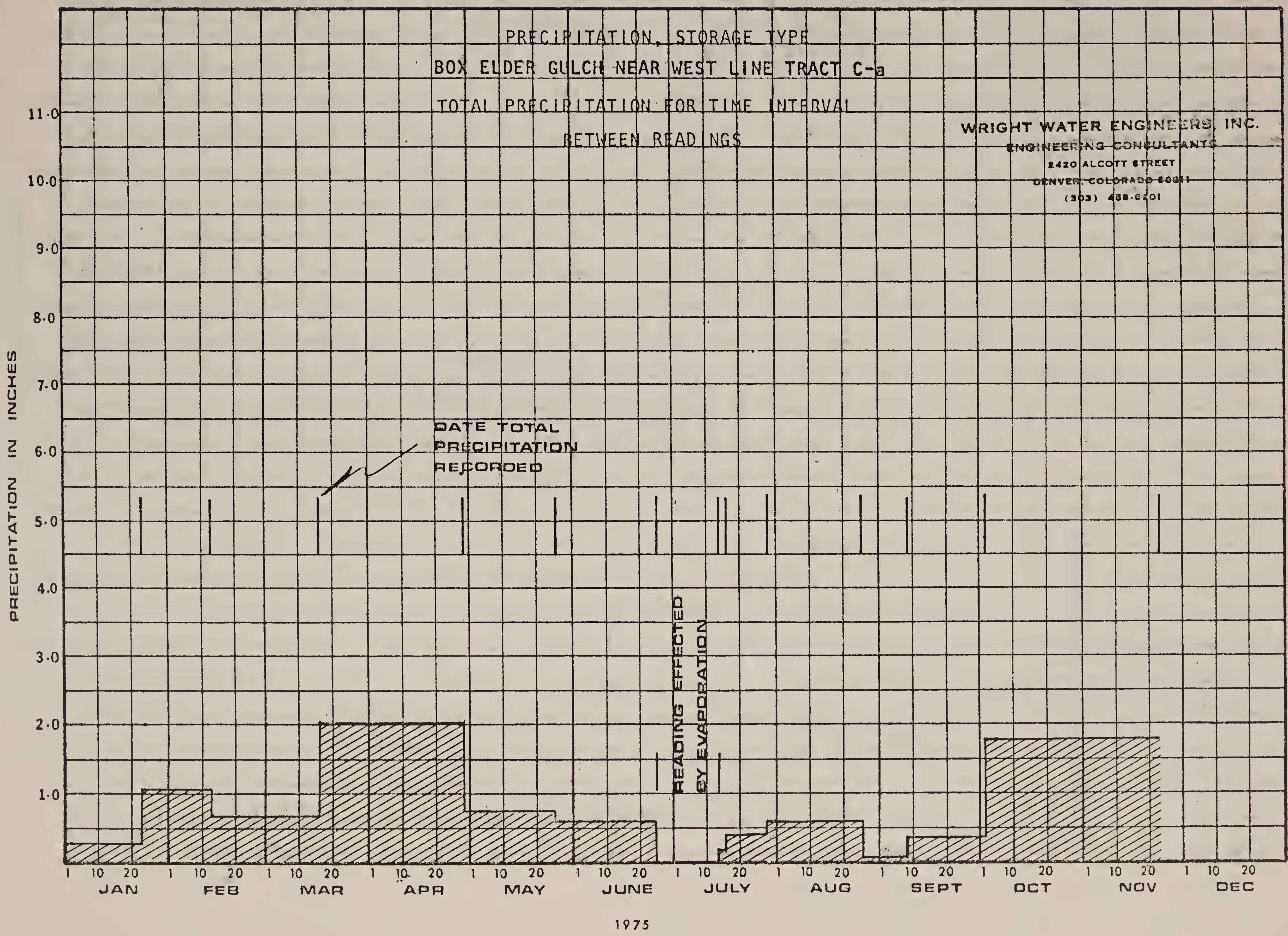

PRECIPITATION, STORAGE TYPE
BOX ELDER GULCH NEAR WEST LINE TRACT C-a
TOTAL PRECIPITATION FOR TIME INTERVAL
BETWEEN READINGS
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
DATE TOTAL
PRECIPITATION
RECORDED
READING EFFECTED
BY EVAPORATION
PRECIPITATION IN INCHES
11.0
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1975

Figure 1.2-40

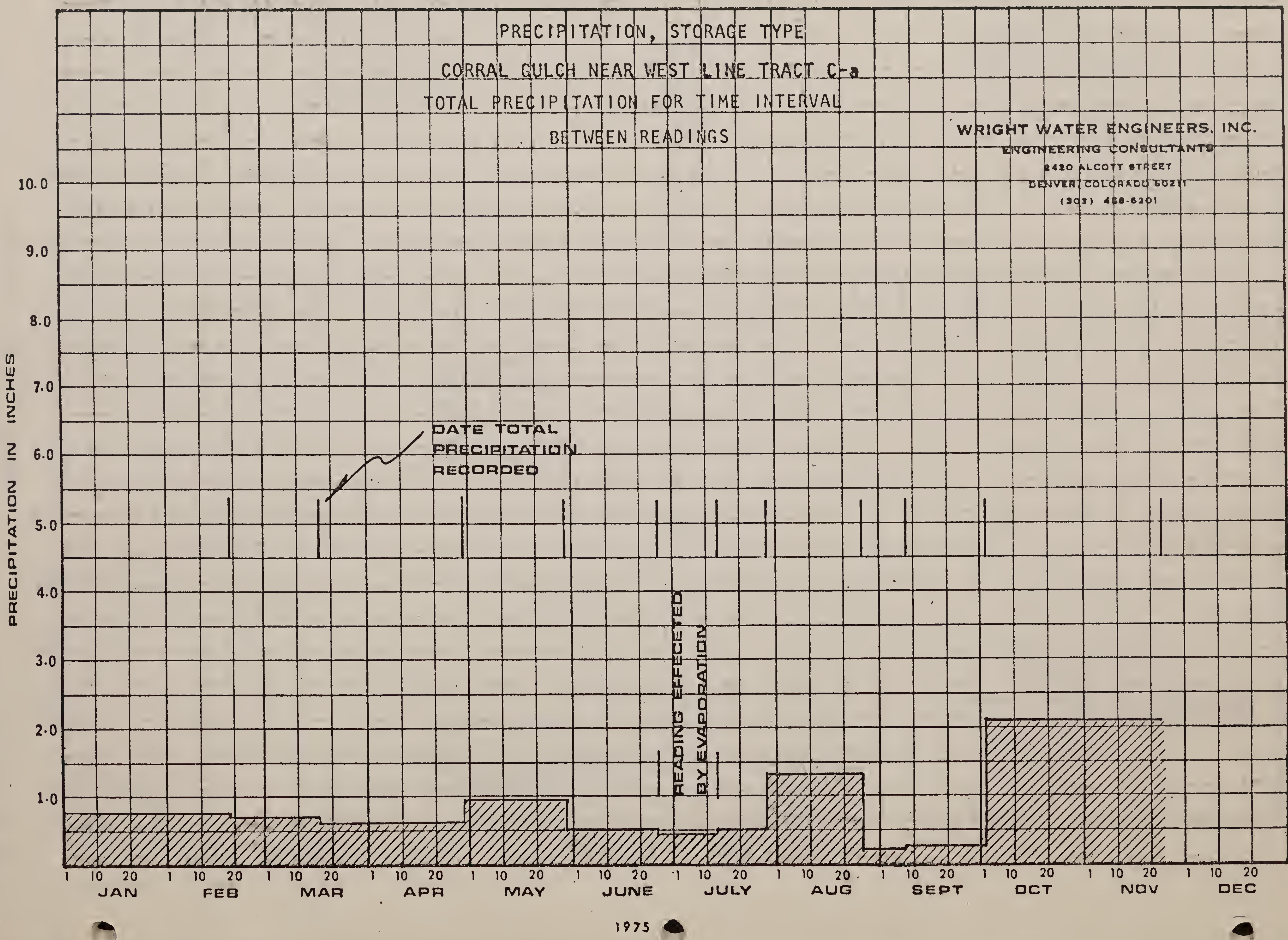

PRECIPITATION, STORAGE TYPE
CORRAL GULCH NEAR WEST LINE TRACT C-a
TOTAL PRECIPITATION FOR TIME INTERVAL
BETWEEN READINGS
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
PRECIPITATION IN INCHES
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
DATE TOTAL PRECIPITATION RECORDED
READING EFFECTED BY EVAPORATION
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1975

Figure 1.2-41

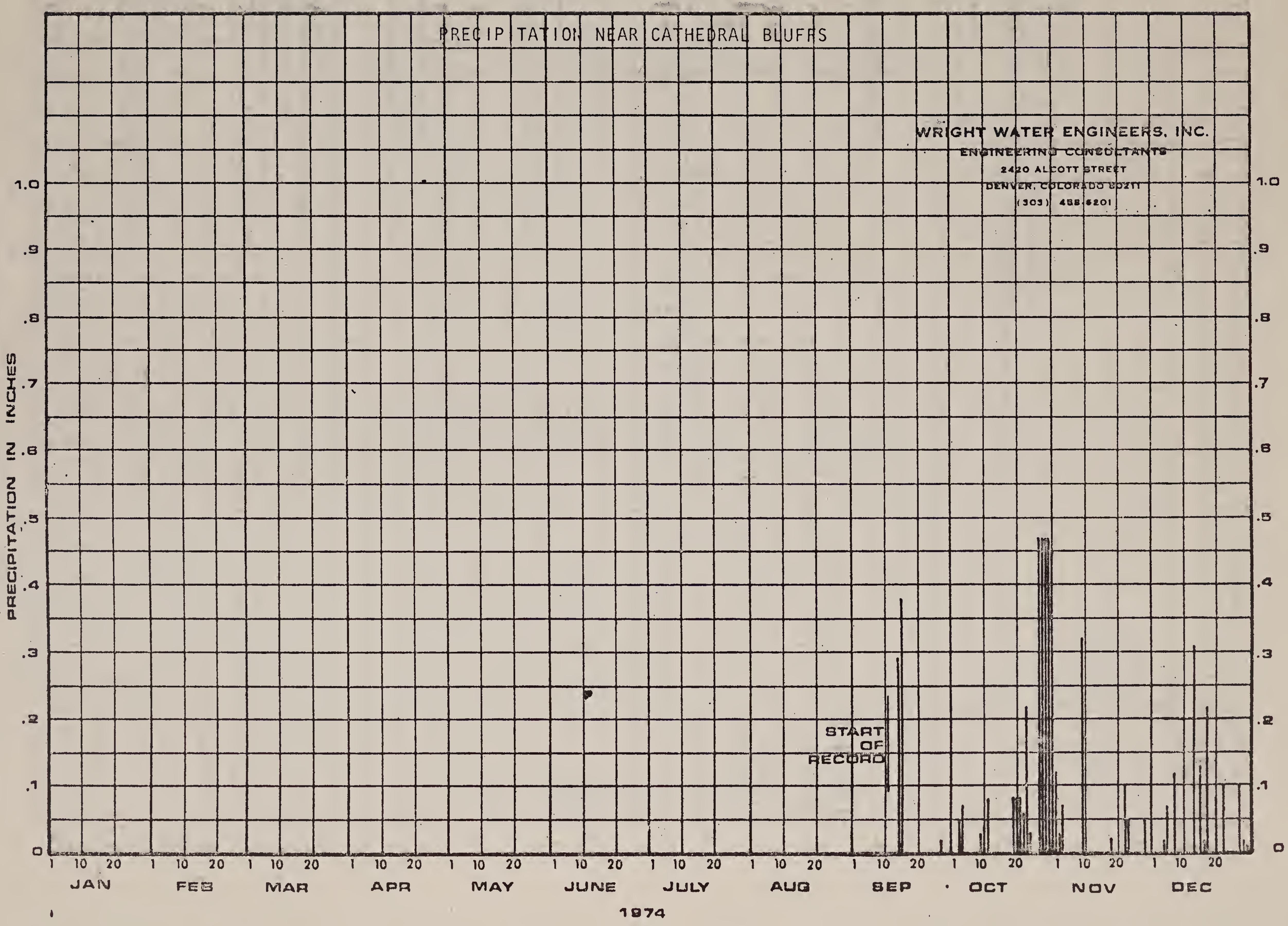

PRECIPITATION NEAR CATHEDRAL BLUFFS
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
PRECIPITATION IN INCHES
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
START OF RECORD
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1974

Figure 1.2-42

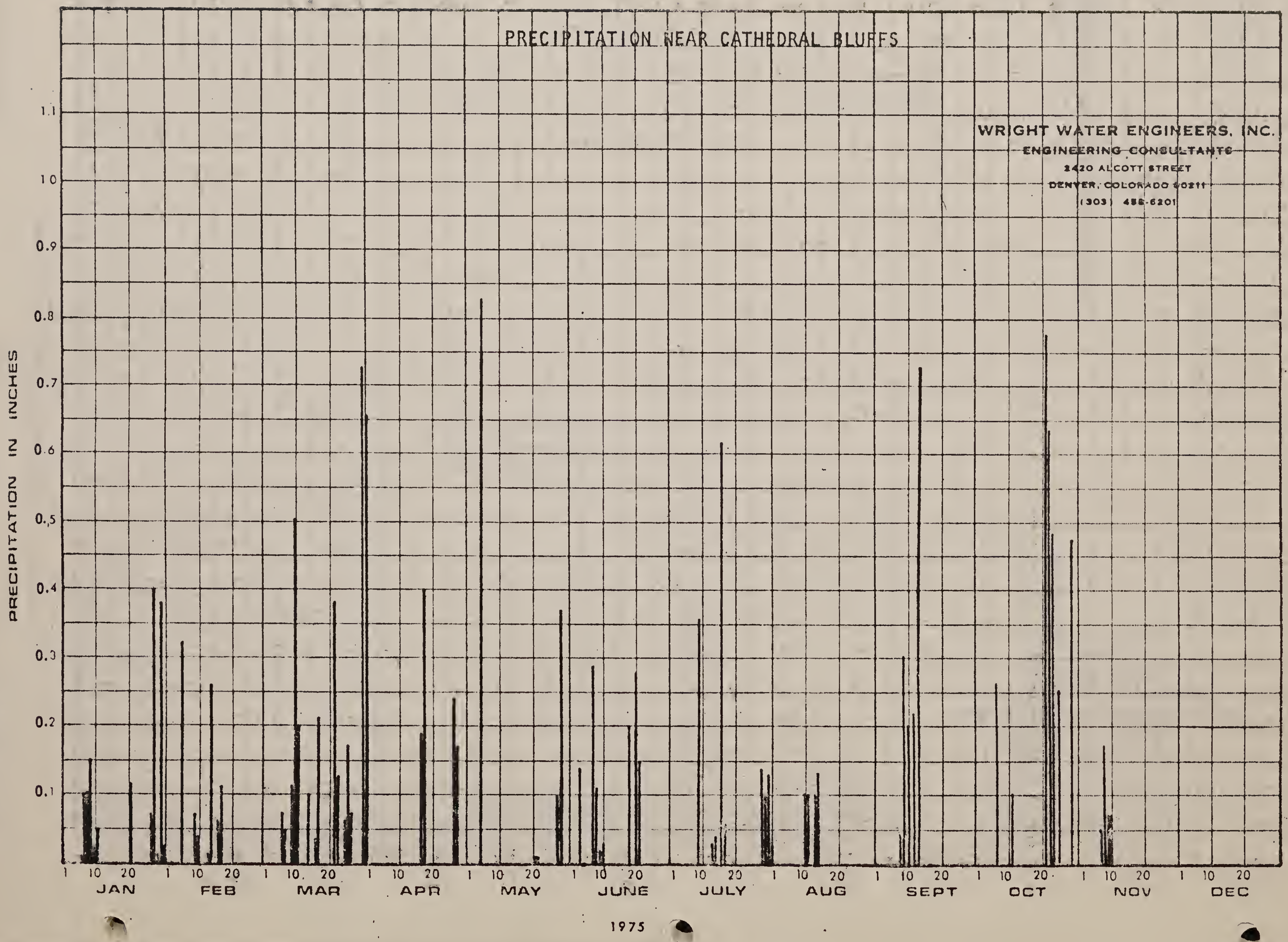

PRECIPITATION NEAR CATHEDRAL BLUFFS
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
PRECIPITATION IN INCHES
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1975

Figure 1.2-43

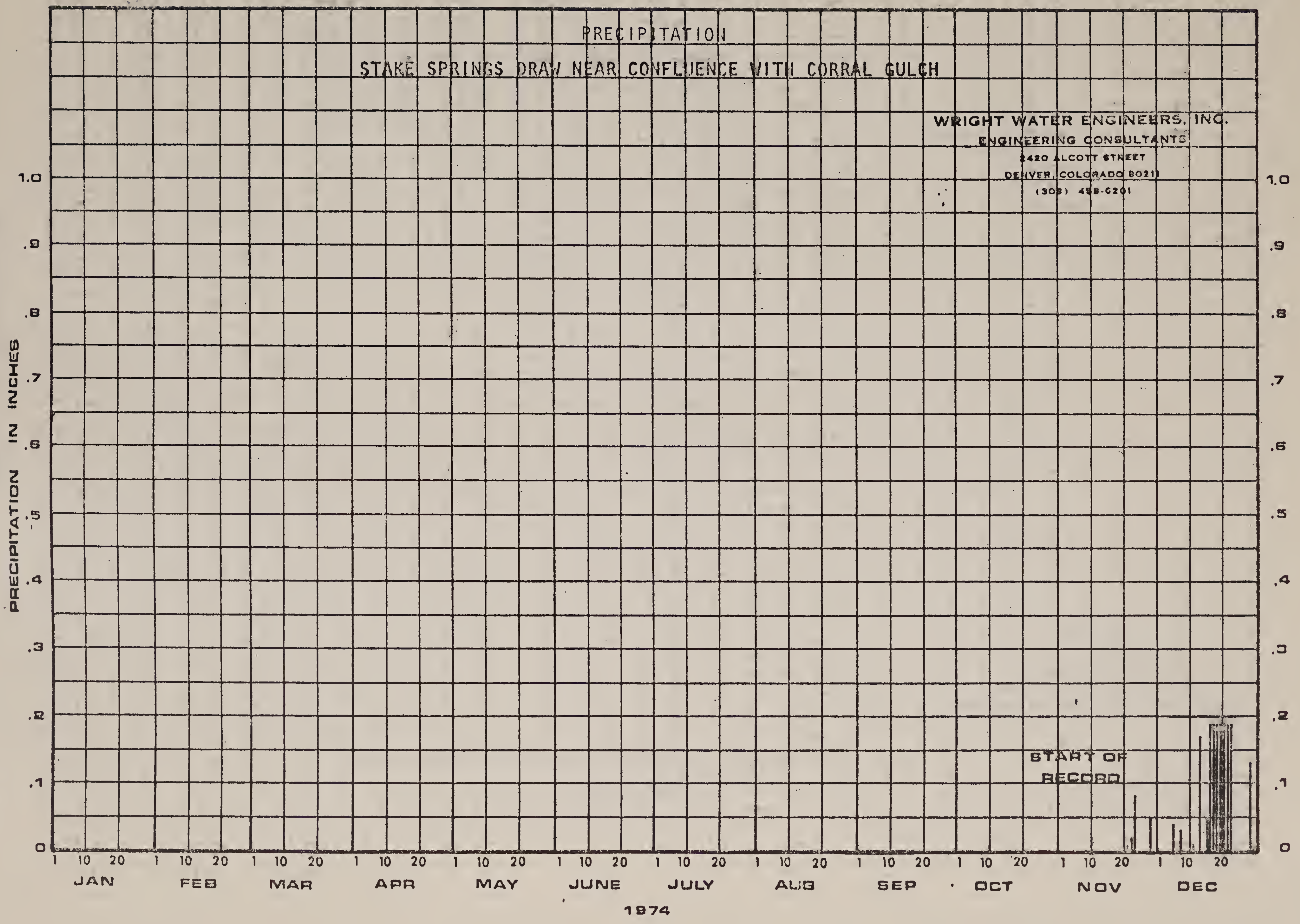

PRECIPITATION
STAKE SPRINGS DRAW NEAR CONFLUENCE WITH CORRAL GULCH
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
PRECIPITATION IN INCHES
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
START OF RECORD
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1974

Figure 1.2-44

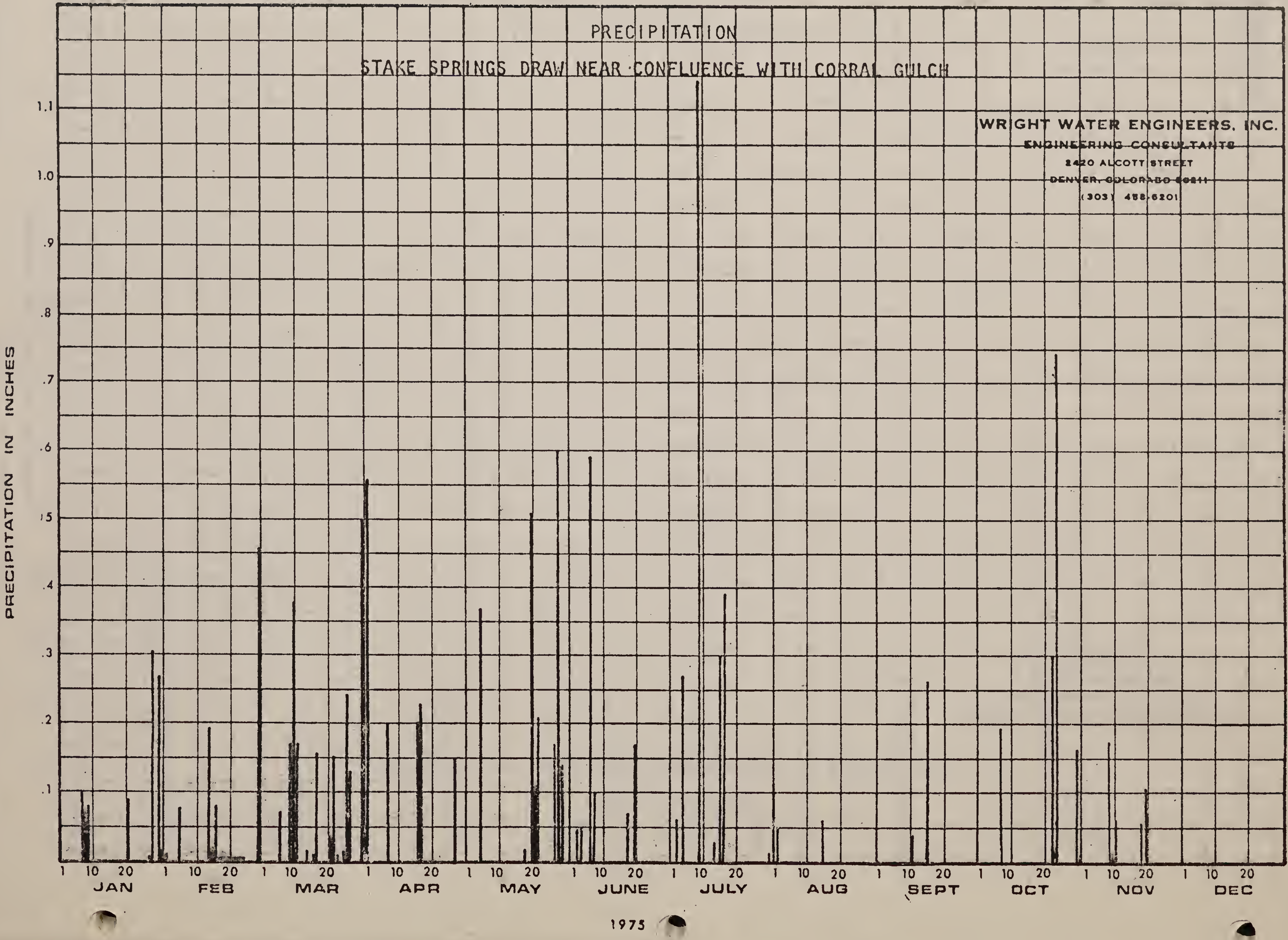

PRECIPITATION
STAKE SPRINGS DRAW NEAR CONFLUENCE WITH CORRAL GULCH
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
PRECIPITATION IN INCHES
1.1
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
1975

Figure 1.2-45

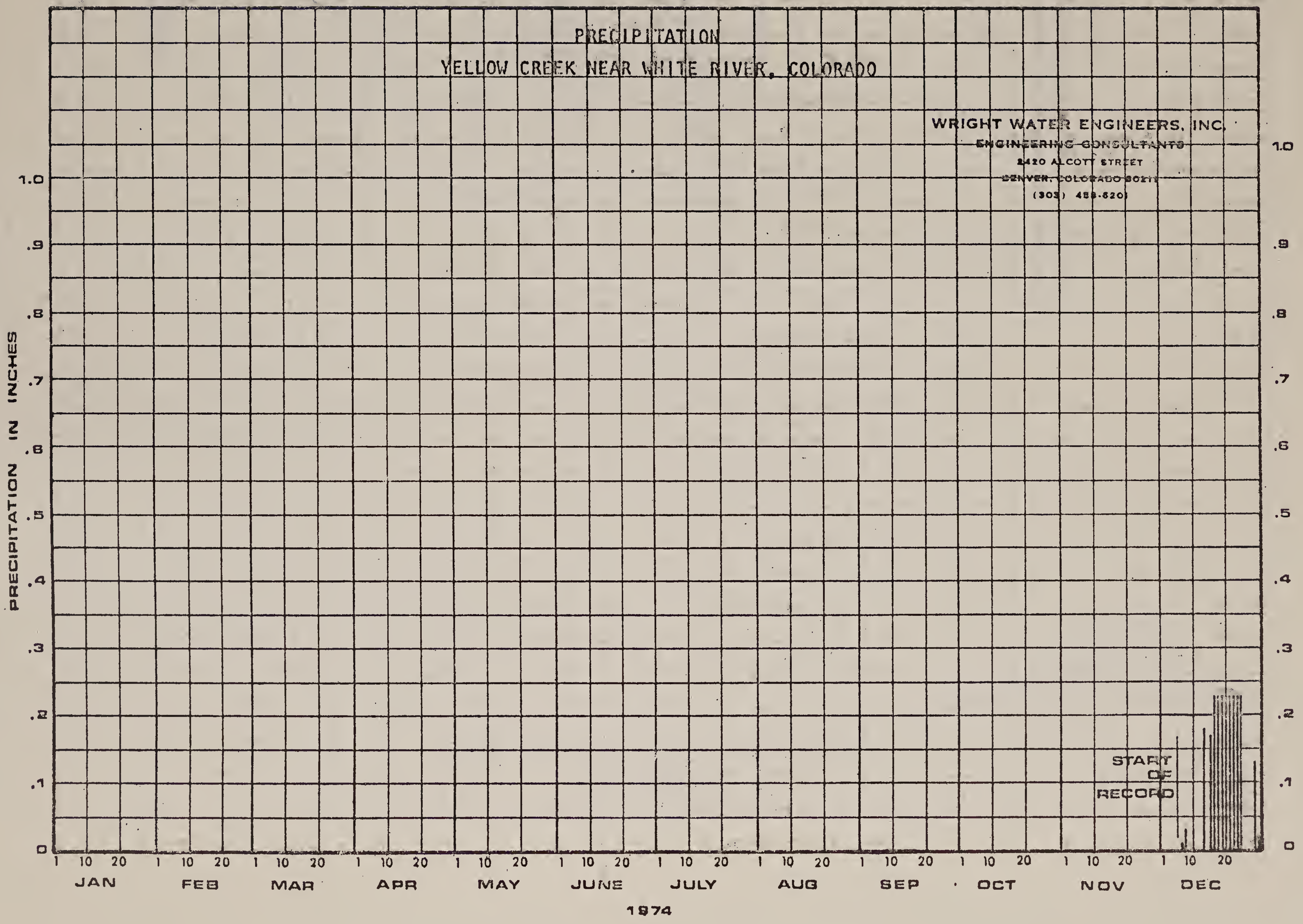

PRECIPITATION
YELLOW CREEK NEAR WHITE RIVER, COLORADO
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
PRECIPITATION IN INCHES
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
START OF RECORD
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1974

Figure 1.2-46

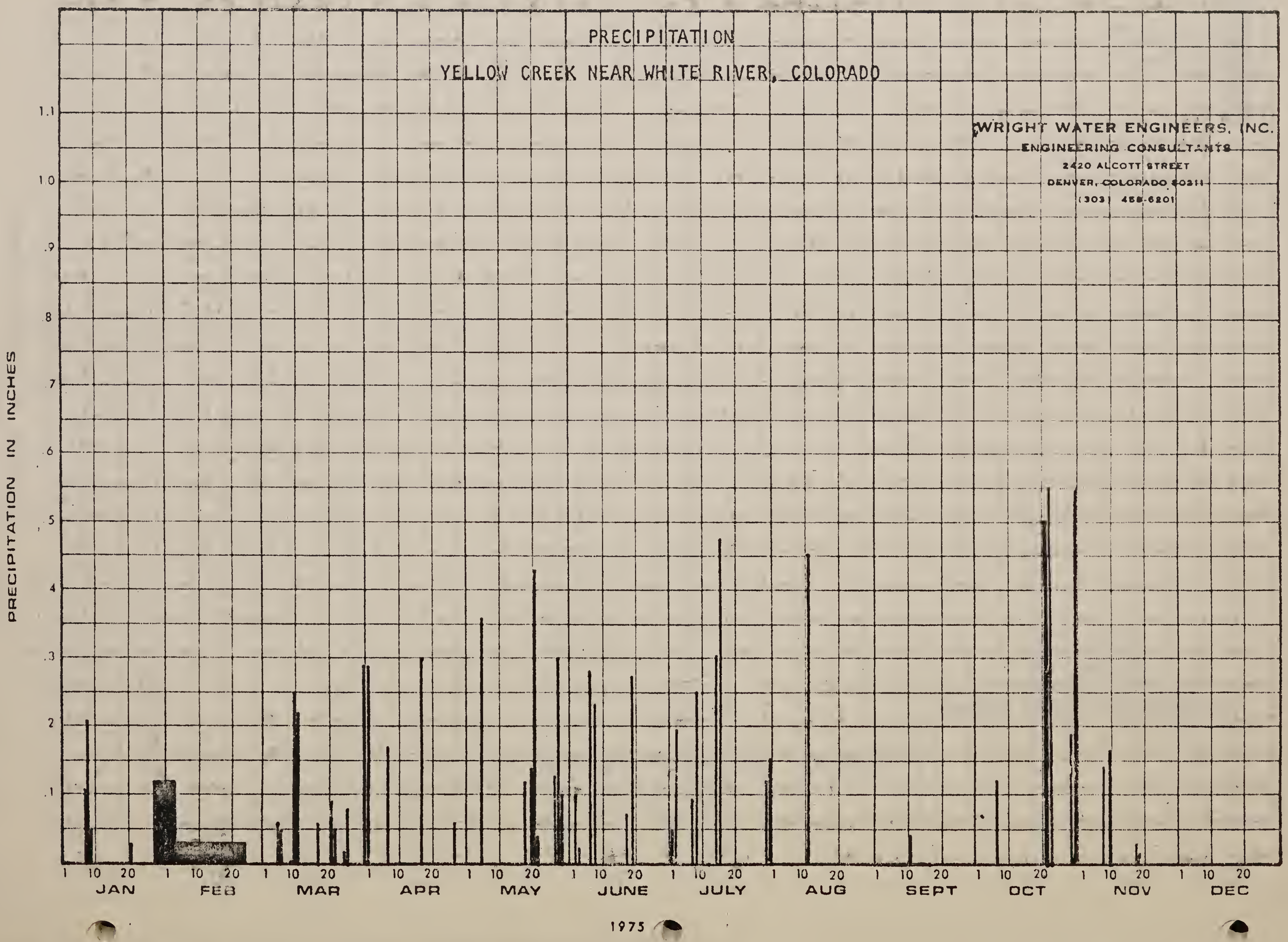

PRECIPITATION
YELLOW CREEK NEAR WHITE RIVER, COLORADO
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
PRECIPITATION IN INCHES
1.1
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
1 10 20 JAN
1 10 20 FEB
1 10 20 MAR
1 10 20 APR
1 10 20 MAY
1 10 20 JUNE
1 10 20 JULY
1 10 20 AUG
1 10 20 SEPT
1 10 20 OCT
1 10 20 NOV
1 10 20 DEC
1975

Figure 1.2-47

1.2.3 ALLUVIAL AQUIFERS

The drilling and completion of fifteen alluvial aquifer test holes associated with Tract C-a were described in RBOSP Progress Reports 2, 3 and 4. The holes which encountered water were: G-S S-7, G-S S-8, G-S S-11, G-S S-12, G-S S-19, G-S S-22, G-S S-23 and G-S S-24.

The alluvium of Dry Fork, "Rinky Dink" Gulch and 84 Mesa has been unsaturated to date as determined from the respective alluvial shallow holes: G-S S-6, S-13 and S-14, and those located near 84 Mesa: G-S S-15 through S-18. Continuous water level recorders (Stevens Type F) were installed at G-S S-7, G-S S-8, G-S S-11, and G-S S-12.

Water quality information, conductivity, temperature, pH, and water level data for the alluvial holes monitored on or near Tract C-a are shown on Figures 1.2-48 through 1.2-63.

When previous data are compared with those collected in September through October, two general trends appear to be present. Temperature continues to drop in all holes during the fall, except G-S S-24. These drops ranged from about .7^{0}C to 4.5^{0}C and averaged 2.6^{0}C change from September through November. Prior to September, temperatures have ranged from 7.5^{0}C to 13.5^{0}C. Water temperatures increased from March through early July and August, then declined.

Water levels generally continue to drop since July. Exceptions to this are G-S S-19 which has been rising since September, and G-S S-7 which rose after troughing in early October. The changes in water levels are from .5 feet to 4 feet (G-S S-8) with an average change of 1.5 feet over September through November. Prior to September's results, the water level increases during May and June in the alluvial holes are thought to be due to infiltration of increased runoff from snowmelt. The magnitude of the increase varied depending upon the drainage system in which the hole was located.

Water levels in alluvial holes GS S-8 and G-S S-11 increased over 5 feet during May. The increase in G-S S-11 is probably due to D-19 pumping test discharge.

Conductivity values from September through November are mostly relatively stable with some slight increases noted in G-S S-7 and G-S S-12. An exception is G-S S-22 which had low conductivities in October. Conductivity values are between 1000 umhos/cm (G-S S-7 and G-S S-8) and 1700 umhos/cm (G-S S-12 and G-S S-23). Changes in September through November averaged about 220 umhos/cm. Prior to September, conductivities ranged from a low of 860 umhos/cm in G-S S-8 to a high of 2275 umhos/cm in G-S S-23. For individual holes, conductivities have been relatively stable with a slight increase and decline during June and July. Also, the decline in conductivity has been associated with constant to slightly-increasing values of total dissolved solids (TDS) which might indicate a change in composition.

Increases in pH values from September through November occurred along Stake Springs Draw, Corral Gulch, and Yellow Creek. These holes are G-S S-12, G-S S-11, G-S S-24 and G-S S-22. Alluvial holes with relatively stable to slight decreases in pH are those holes furthest upstream, G-S S-7, G-S S-8, on Corral Gulch and Box Elder Gulch or those that lie along Duck Creek, G-S S-19, and G-S S-23.

October and November pH values remained between 6.0 and 6.3 with changes being up to about .4 units. Prior to September, the pH ranged between 6.0 and 7.2 with an average of 6.7.

Figures 1.2-48 through 1.2-55 are plots of static water level and conductivity, and Figures 1.2-56 through 1.2-63 show plots of temperature and pH.

Maximum, minimum and average values for wet chemical and spectrographic analyses are presented in Table 1.2-8 and Table 1.2-9.

TABLE 1.2-8

WATER QUALITY ANALYSIS SUMMARY

WET CHEMICAL ANALYSIS

ALLUVIAL AQUIFERS

MARCH TO OCTOBER, 1975

Item	Low	High	Average	No. Items Averaged
Alkalinity	329.000	620.000	470.771	65
Aluminum	<0.100	<0.100	---	4
Ammonia	<0.100	1.100	0.272	54
Arsenic	<0.010	0.010	---	65
Barium	<1.000	<1.000	---	65
Bicarbondat	370.000	755.000	567.769	65
Boron	<0.010	27.000	1.666	65
Cadmium	<0.010	0.090	0.007	65
Calcium	28.000	210.000	95.846	65
Carbonate	<0.100	605.000	15.969	65
Chloride	6.800	71.000	17.542	65
Chromium	<0.050	<0.010	---	64
Conductance	860.000	2370.000	1543.775	65
Copper	<0.100	3.200	0.158	65
Cyanide	<0.010	0.010	---	65
Dissolved Solids	640.000	1670.000	1153.154	65
Fluoride	<0.100	1.200	0.387	64
Gross Alpha	1.400	21.000	9.348	61
Gross Beta	1.000	35.000	10.680	15
Hardness	280.000	810.000	593.385	65
Hydroxide	---	---	---	0
Iron	<0.050	28.000	7.326	65
Lead	0.020	0.900	0.244	64
Lithium	---	---	---	0
Magnesium	3.700	145.000	86.292	65
Manganese	<0.050	17.000	2.429	65
Mercury	<0.010	0.002	---	65
Nickel	0.010	0.200	0.053	65
Nitrate	<0.100	21.000	5.228	65
pH	6.000	7.200	6.560	65
Phosphate	<0.100	0.200	0.008	65
Potassium	---	---	---	0
Selenium	<0.100	<0.010	---	65
Silicon Dioxide	22.000	44.000	32.000	65
Silver	<0.100	0.070	0.004	64
Sodium	75.000	310.000	188.462	65
Sulfate	145.000	780.000	435.308	65
Sulfide	---	---	---	0
TOC	5.000	270.000	50.344	61
Zinc	<0.100	5.700	0.561	63

--- Less than minimum detectable amount

TABLE 1.2-9

SUMMARY OF QUALITATIVE SPECTROGRAPHIC ANALYSIS

ALLUVIAL AQUIFER

MARCH TO OCTOBER, 1975

Item	Low	High	Average	No. Items Averaged
Aluminum	0.005	1.000	0.138	64
Antimony	---	---	---	0
Arsenic	---	---	---	0
Barium	0.001	0.010	0.002	18
Beryllium	---	---	---	0
Bismuth	---	---	---	0
Boron	0.100	0.500	0.347	64
Cadmium	---	---	---	0
Calcium	10.000	Major	10.000	5
Cerium	---	---	---	0
Cesium	0.001	0.001	0.001	1
Chromium	---	---	---	1
Cobolt	---	---	---	0
Columbium	---	---	---	0
Copper	0.001	0.020	0.007	61
Dysprosium	1.000	1.000	1.000	1
Erbium	---	---	---	0
Europium	---	---	---	0
Gadolinium	---	---	---	0
Gallium	---	---	---	0
Germanium	---	---	---	0
Gold	---	---	---	0
Hafnium	---	---	---	0
Holmium	---	---	---	0
Indium	---	---	---	0
Iridium	---	---	---	0
Iron	0.010	0.500	0.048	64
Lanthanum	---	---	---	0
Lead	0.001	0.010	0.002	11
Lithium	0.001	0.100	0.009	54
Lutetium	---	---	---	0
Magnesium	5.000	Major	2505.375	8
Manganese	0.001	0.100	0.016	63
Mercury	---	---	---	0
Molybdenum	0.001	0.050	0.006	31
Neodymium	---	---	---	0
Nickel	0.070	0.070	0.070	1
Osmium	---	---	---	0
Palladium	---	---	---	0
Platinum	---	---	---	0
Potassium	0.010	2.000	0.660	64

TABLE 1.2- 9
(Continued)

Item	Low	High	Average	No. Items Averaged
Praseodymi	---	---	---	0
Radium	0.100	1.200	0.343	47
Rhenium	---	---	---	0
Rhodium	---	---	---	0
Rubidium	---	---	---	0
Ruthenium	---	---	---	0
Samarium	---	---	---	0
Scandium	---	---	---	0
Selenium	---	---	---	0
Silicon	2.000	20.000	5.188	64
Silver	0.000	0.001	---	10
Sodium	2.000	Major	6.977	44
Strontium	0.010	0.100	0.094	61
Tantalum	---	---	---	0
Terbium	---	---	---	0
Thallium	---	---	---	0
Thorium	---	---	---	0
Thulium	---	---	---	0
Tin	0.001	0.001	0.001	2
Titanium	0.001	0.020	0.004	49
Tungsten	---	---	---	0
Uranium	---	---	---	0
Vanadium	---	---	---	0
Ytterbium	---	---	---	0
Yttrium	---	---	---	0
Zinc	0.001	0.010	0.001	21
Zirconium	---	---	---	0

--- Less than minimum detectable amount

Major - Concentration too large to quantify
(See wet chemical analysis Table 1.2-9)

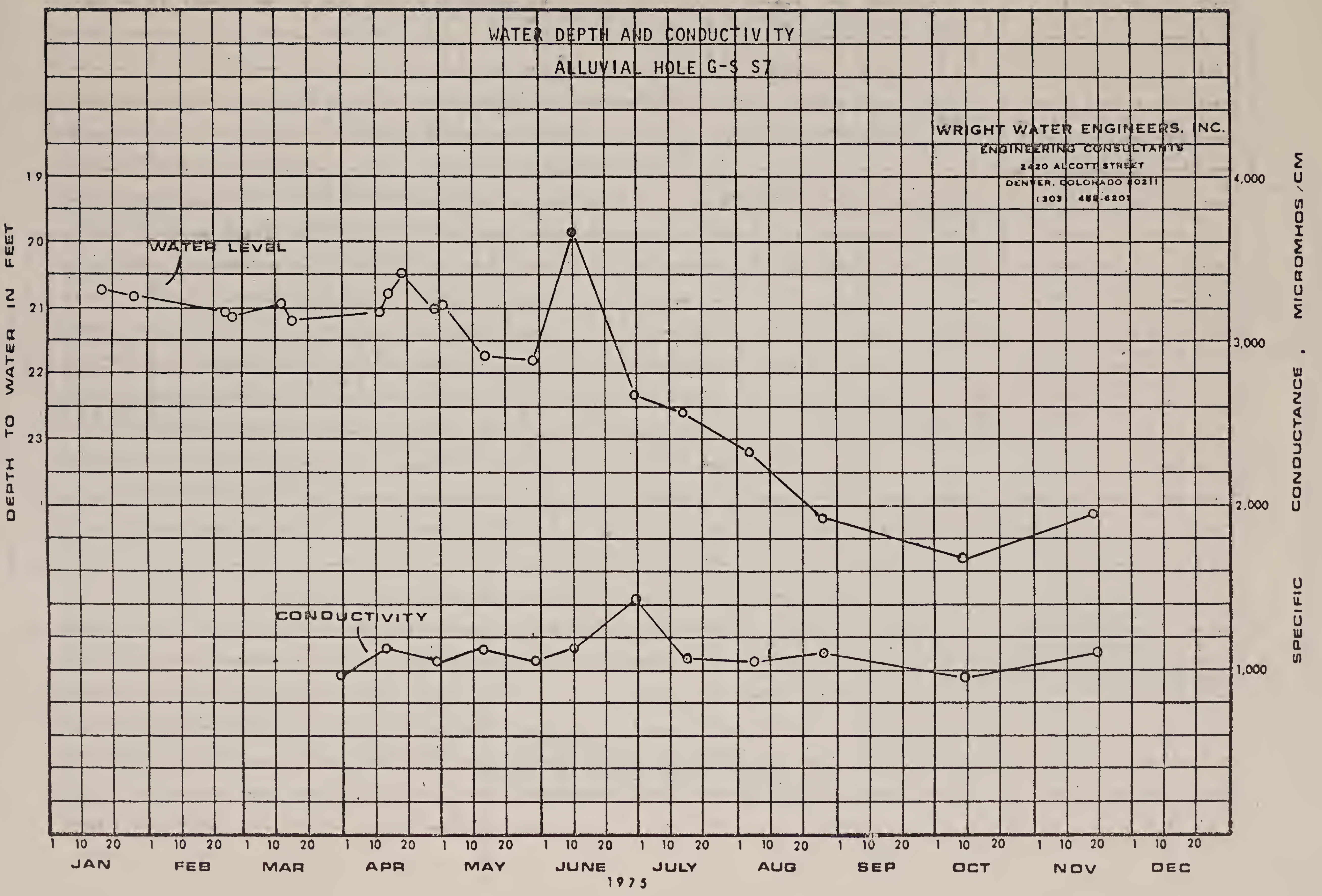

WATER DEPTH AND CONDUCTIVITY
ALLUVIAL HOLE G-S S7
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
WATER LEVEL
CONDUCTIVITY
DEPTH TO WATER IN FEET
19
20
21
22
23
SPECIFIC CONDUCTANCE, MICROMHOS/CM
4,000
3,000
2,000
1,000
1 10 20 JAN
1 10 20 FEB
1 10 20 MAR
1 10 20 APR
1 10 20 MAY
1 10 20 JUNE
1 10 20 JULY
1 10 20 AUG
1 10 20 SEP
1 10 20 OCT
1 10 20 NOV
1 10 20 DEC
1975

Figure 1.2-48

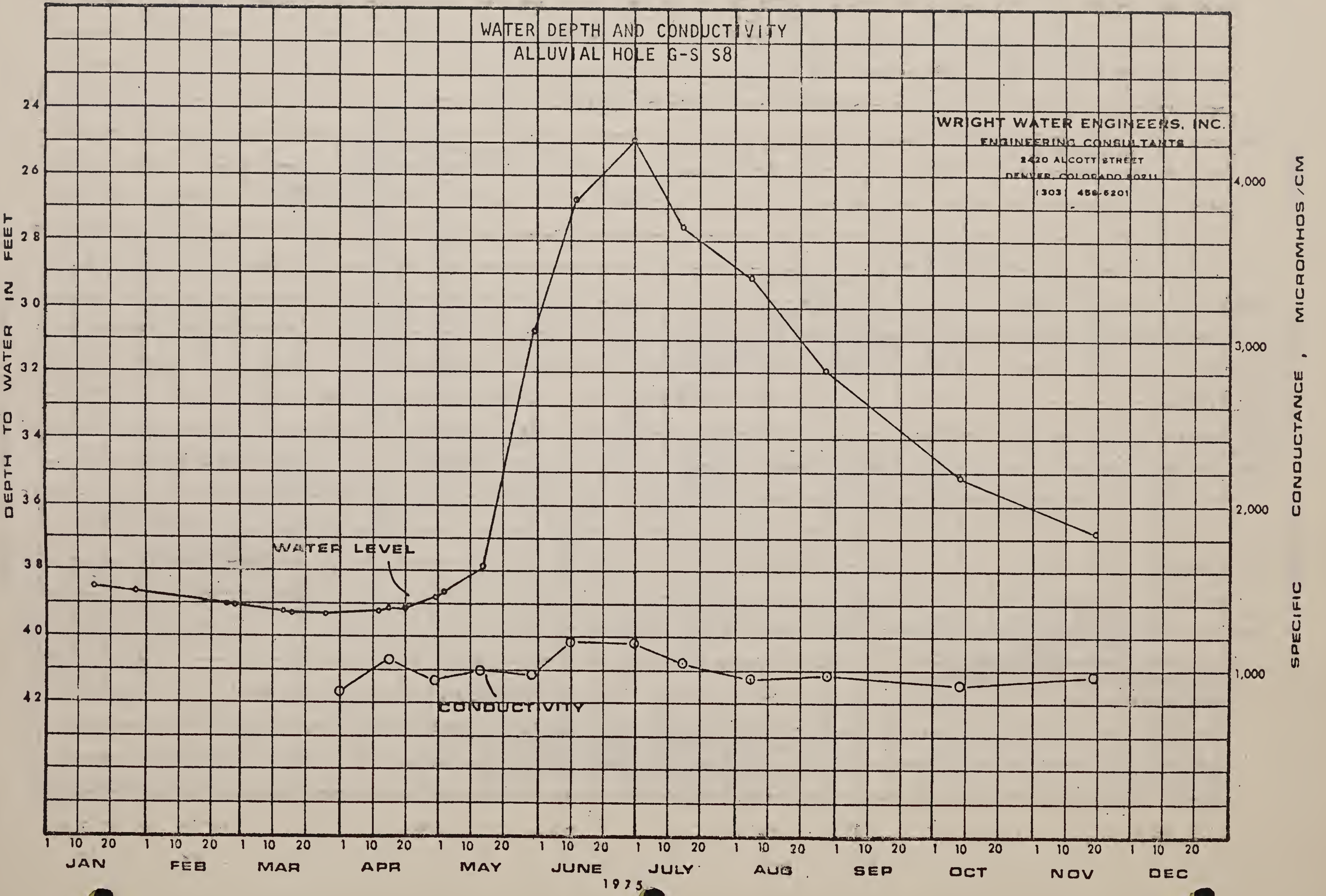

WATER DEPTH AND CONDUCTIVITY
ALLUVIAL HOLE G-S S8
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
DEPTH TO WATER IN FEET
24
26
28
30
32
34
36
38
40
42
SPECIFIC CONDUCTANCE, MICROMHOS/CM
4,000
3,000
2,000
1,000
WATER LEVEL
CONDUCTIVITY
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1975

Figure 1.2-49

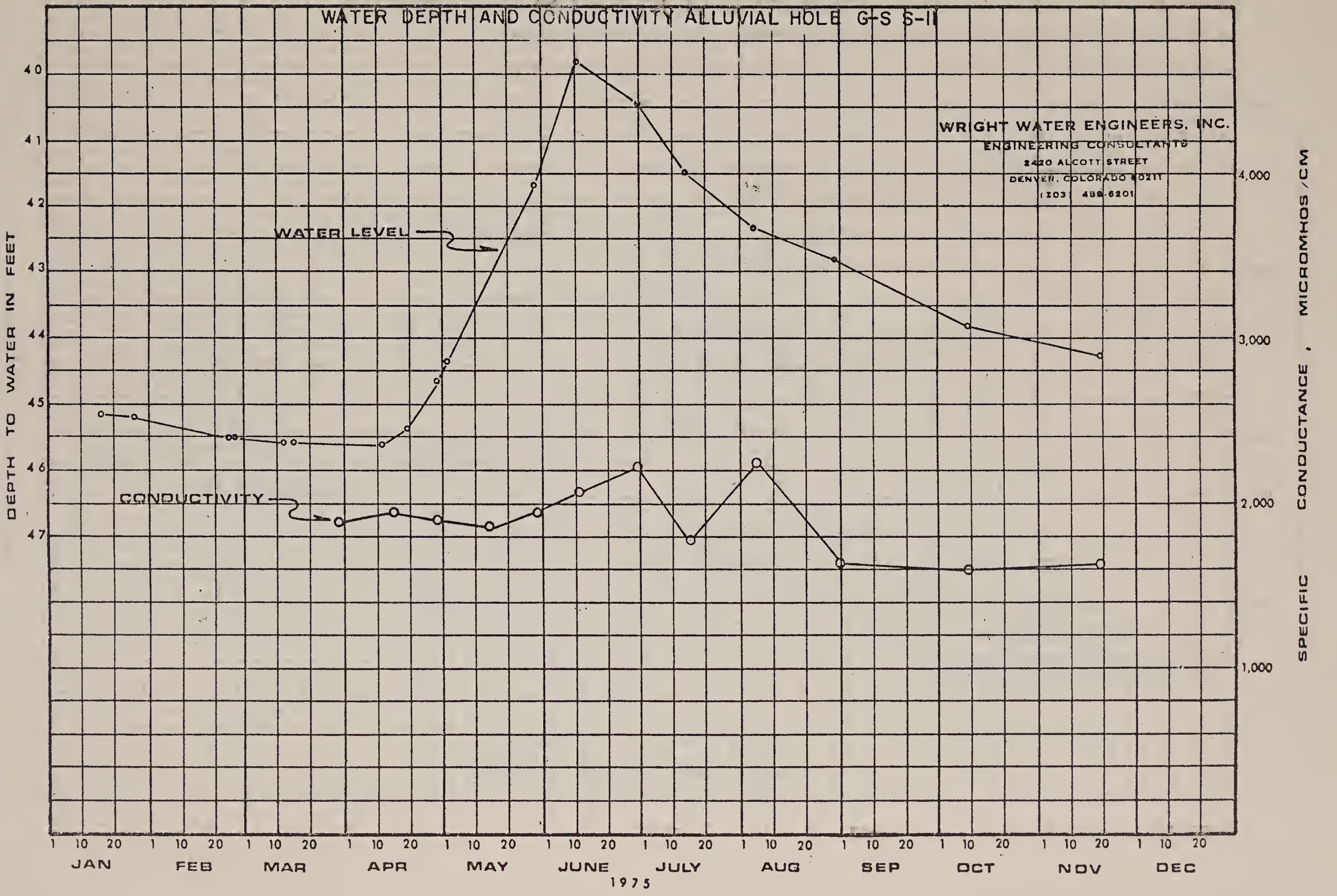

WATER DEPTH AND CONDUCTIVITY ALLUVIAL HOLE G-S S-II
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 488-6201
WATER LEVEL
CONDUCTIVITY
DEPTH TO WATER IN FEET
40
41
42
43
44
45
46
47
SPECIFIC CONDUCTANCE, MICROMHOS/CM
4,000
3,000
2,000
1,000
1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1975

Figure 1.2-50

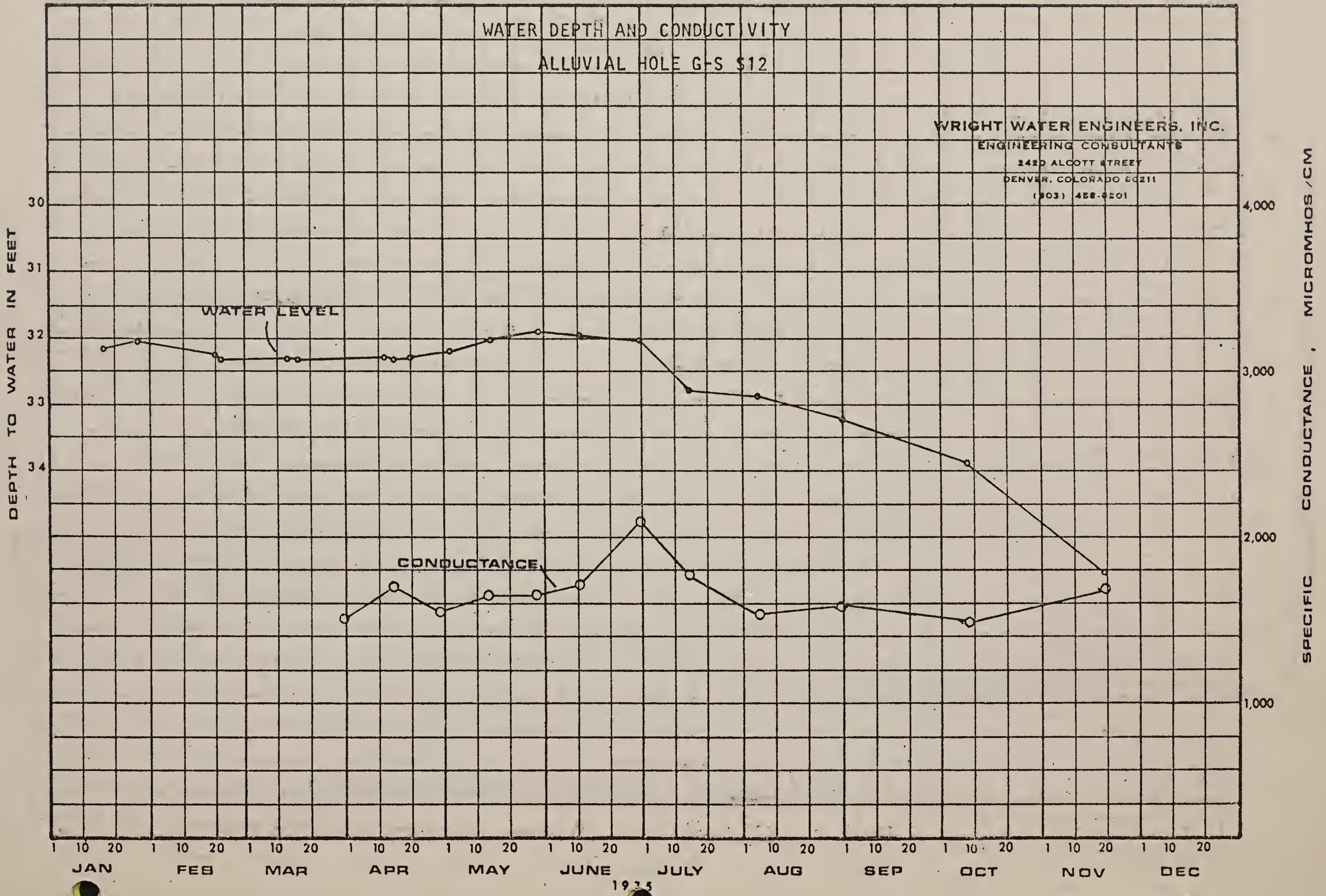
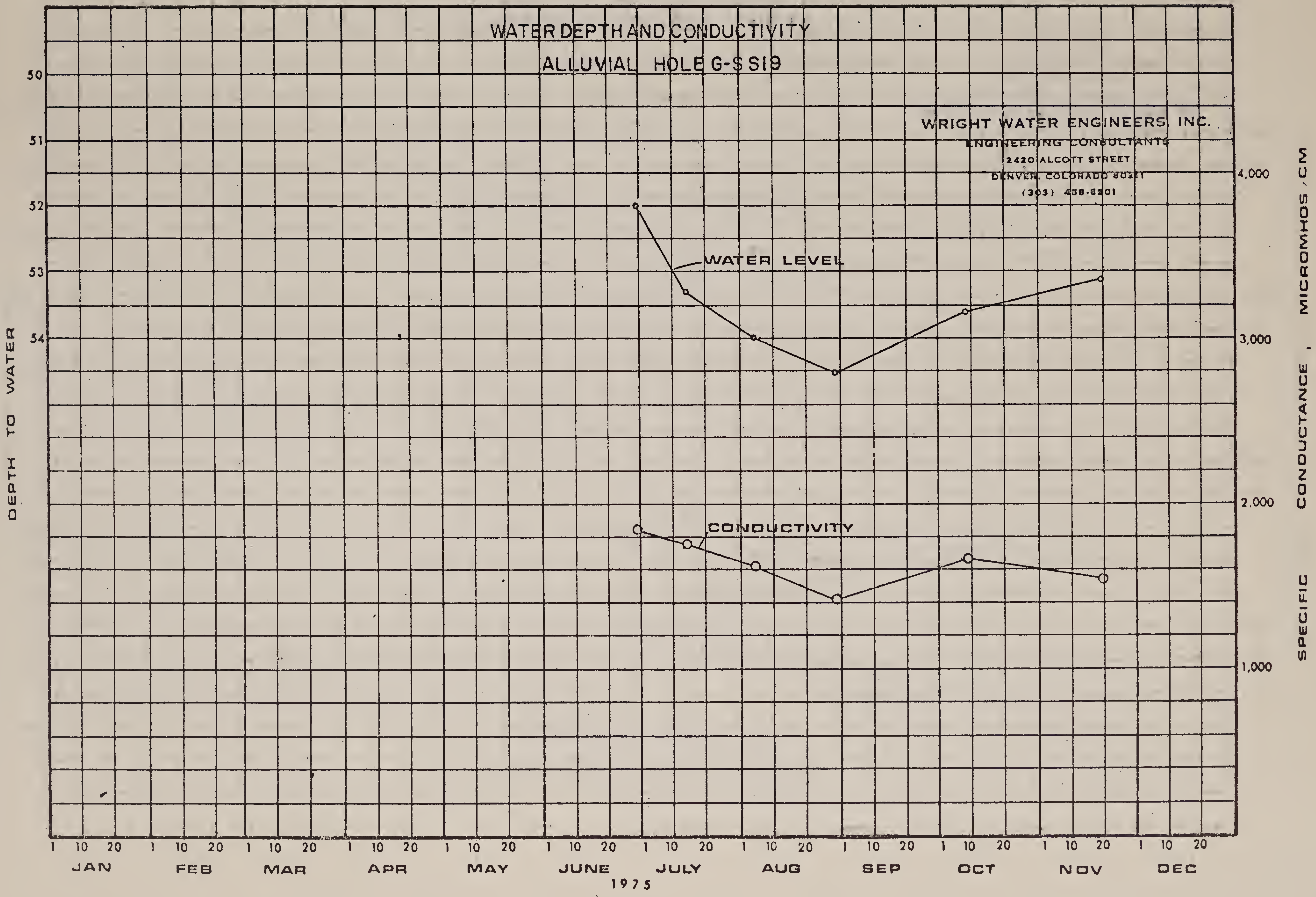

WATER DEPTH AND CONDUCTIVITY
ALLUVIAL HOLE G-S 512
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
DEPTH TO WATER IN FEET
30
31
32
33
34
SPECIFIC CONDUCTANCE, MICROMHOS/CM
4,000
3,000
2,000
1,000
WATER LEVEL
CONDUCTANCE
1 10 20 JAN
1 10 20 FEB
1 10 20 MAR
1 10 20 APR
1 10 20 MAY
1 10 20 JUNE
1 10 20 JULY
1 10 20 AUG
1 10 20 SEP
1 10 20 OCT
1 10 20 NOV
1 10 20 DEC
1975

Figure 1.2-51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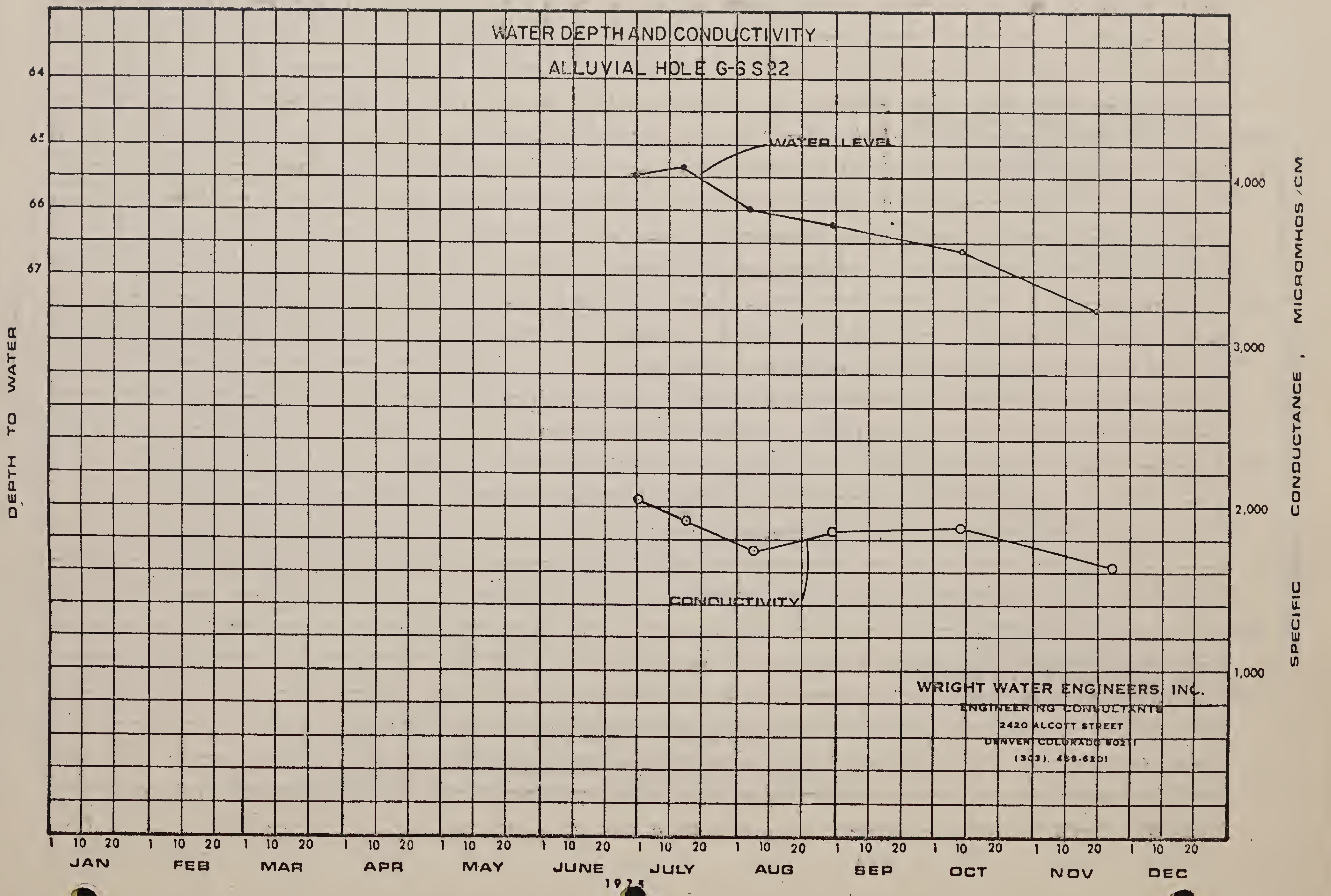
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
WATER LEVEL
CONDUCTIVITY
DEPTH TO WATER
50
51
52
53
54
SPECIFIC CONDUCTANCE, MICROMHOS/CM
4,000
3,000
2,000
1,000
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1975

Figure 1.2-52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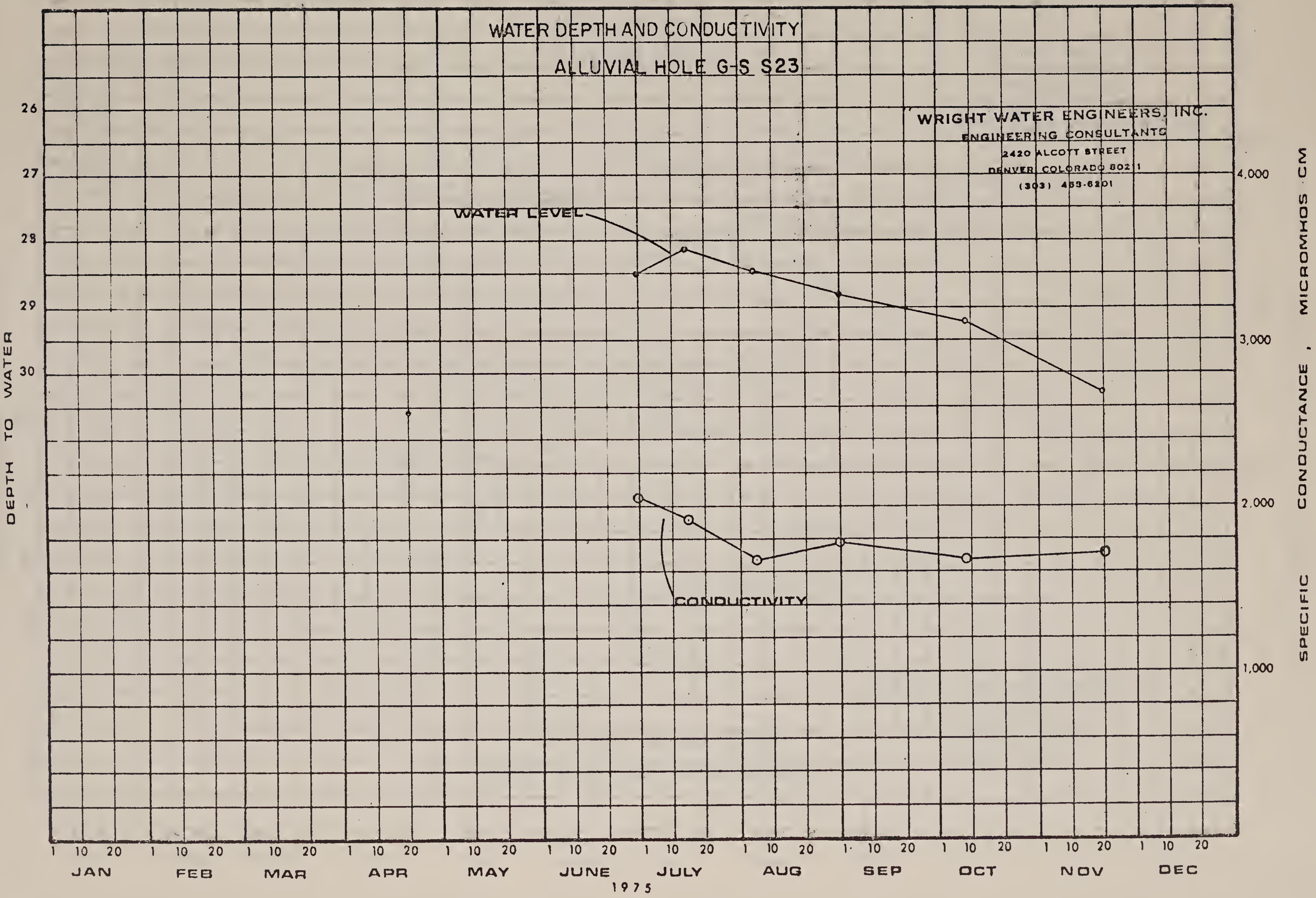
ALLUVIAL HOLE G-6 S22
WATER LEVEL
CONDUCTIVITY
DEPTH TO WATER
64
65
66
67
SPECIFIC CONDUCTANCE, MICROMHOS/CM
4,000
3,000
2,000
1,000
1 10 20 JAN
1 10 20 FEB
1 10 20 MAR
1 10 20 APR
1 10 20 MAY
1 10 20 JUNE
1 10 20 JULY
1 10 20 AUG
1 10 20 SEP
1 10 20 OCT
1 10 20 NOV
1 10 20 DEC
1975
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201

Figure 1.2-53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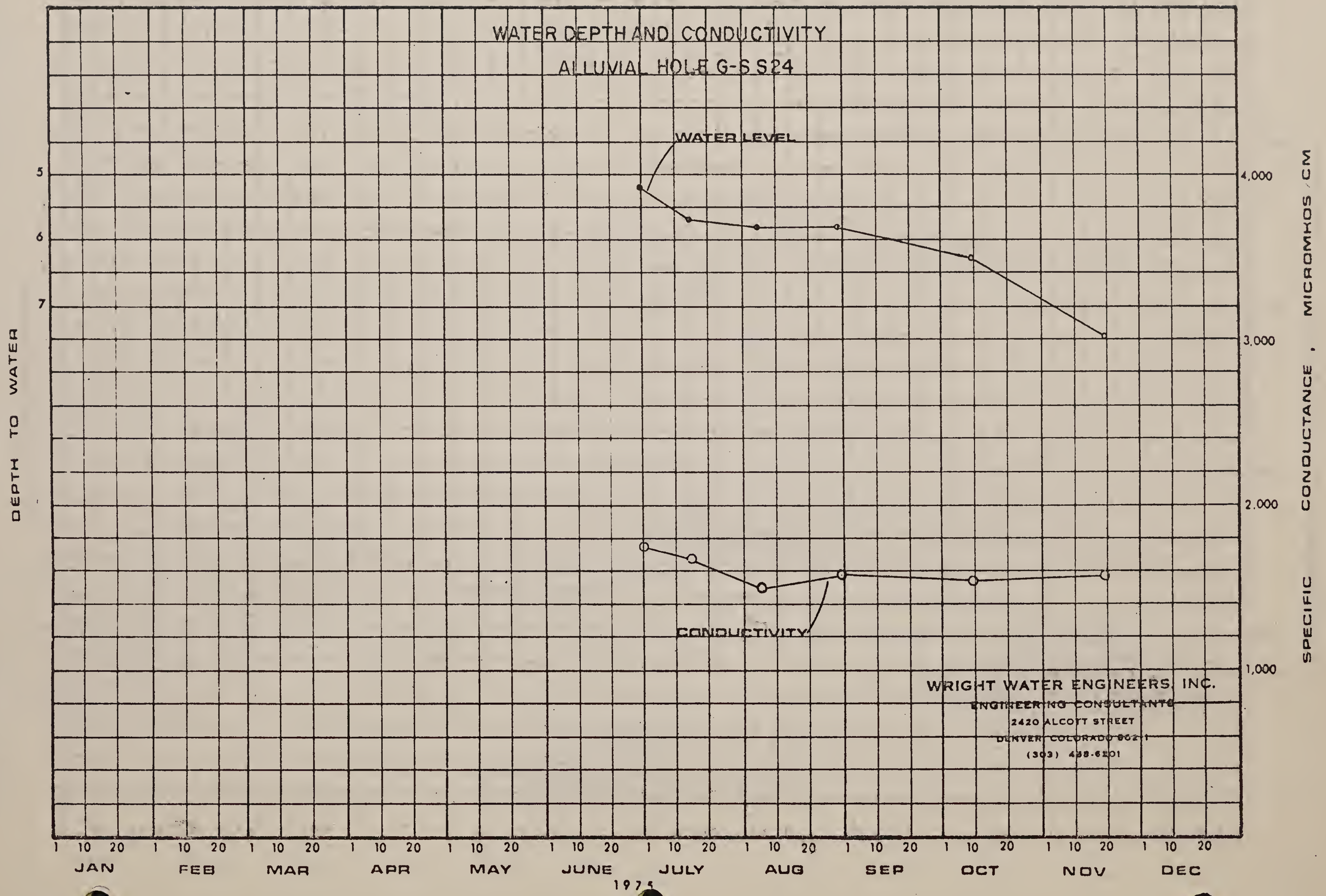
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 433-6201
WATER LEVEL
CONDUCTIVITY
DEPTH TO WATER
26
27
28
29
30
SPECIFIC CONDUCTANCE, MICROMHOS CM
4,000
3,000
2,000
1,000
1 10 20 JAN
1 10 20 FEB
1 10 20 MAR
1 10 20 APR
1 10 20 MAY
1 10 20 JUNE
1 10 20 JULY
1 10 20 AUG
1 10 20 SEP
1 10 20 OCT
1 10 20 NOV
1 10 20 DEC
1975

Figure 1.2-54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ALLUVIAL HOLE G-S S24
WATER LEVEL
CONDUCTIVITY
DEPTH TO WATER
5
6
7
SPECIFIC CONDUCTANCE, MICROMHOS/CM
4,000
3,000
2,000
1,000
1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1975
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 802-1
(303) 458-6201

Figure 1.2-55

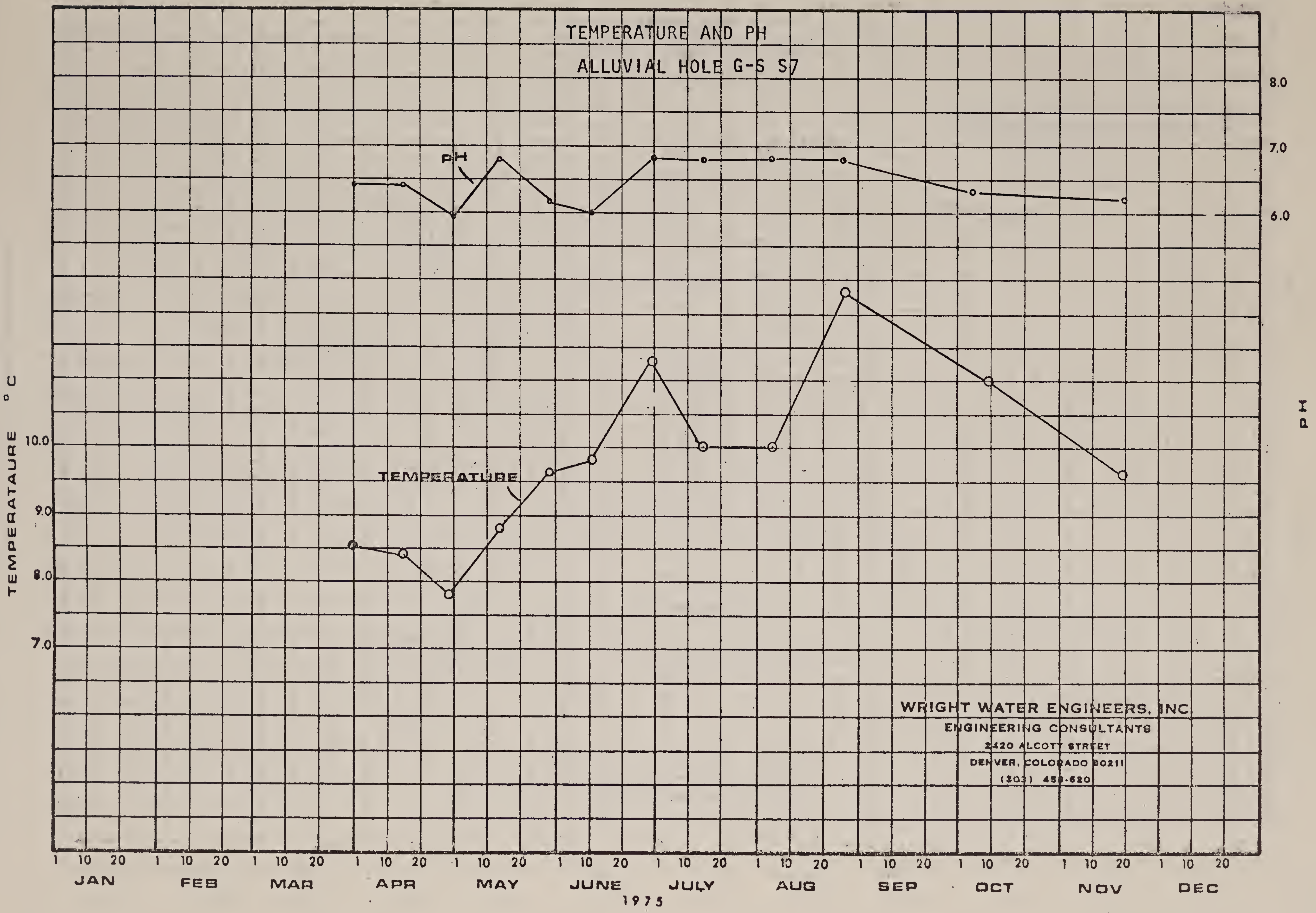

TEMPERATURE AND PH
ALLUVIAL HOLE G-S S7
PH
TEMPERATURE
TEMPERATAURE °C
10.0
9.0
8.0
7.0
PH
8.0
7.0
6.0
1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20
JAN FEB MAR APR MAY JUNE JULY AUG SEP OCT NOV DEC
1975
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-620

Figure 1.2-56

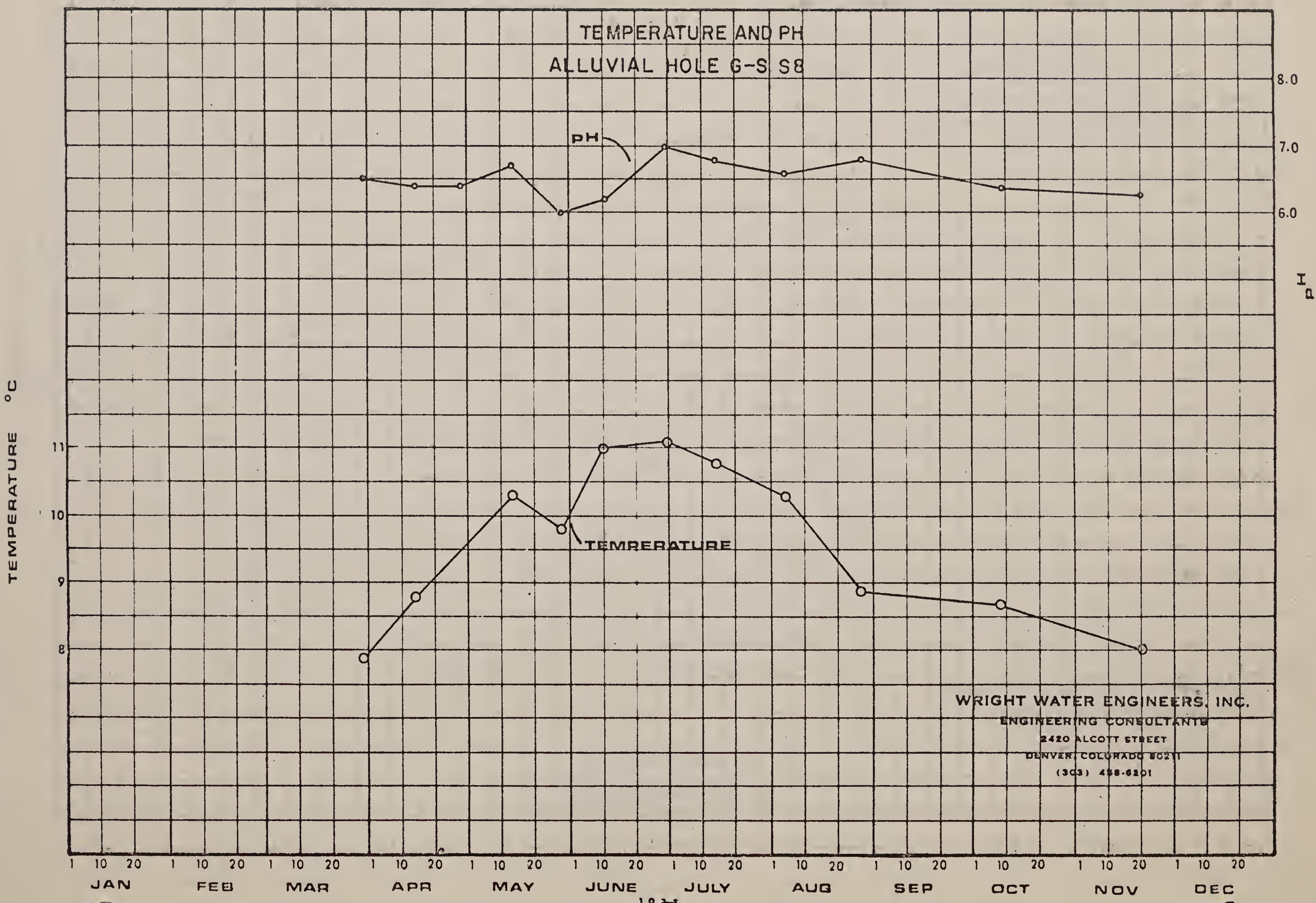

TEMPERATURE AND PH
ALLUVIAL HOLE G-S S8
pH
TEMPERATURE
8.0
7.0
6.0
pH
TEMPERATURE °C
11
10
9
8
1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1975
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201

Figure 1.2-57

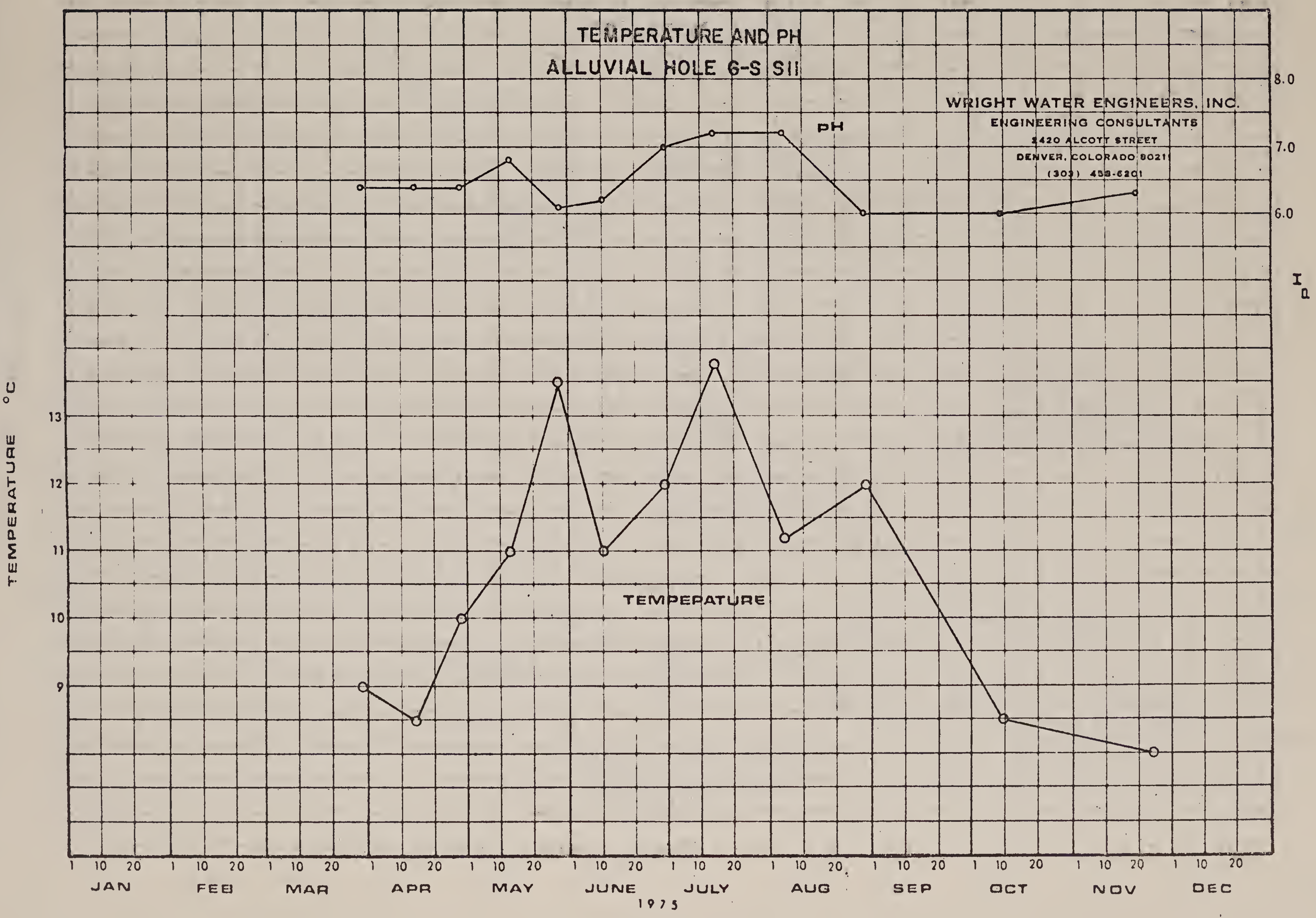

TEMPERATURE AND PH
ALLUVIAL HOLE 6-S SII
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
pH
8.0
7.0
6.0
pH
TEMPERATURE °C
13
12
11
10
9
TEMPERATURE
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1975

Figure 1.2-58

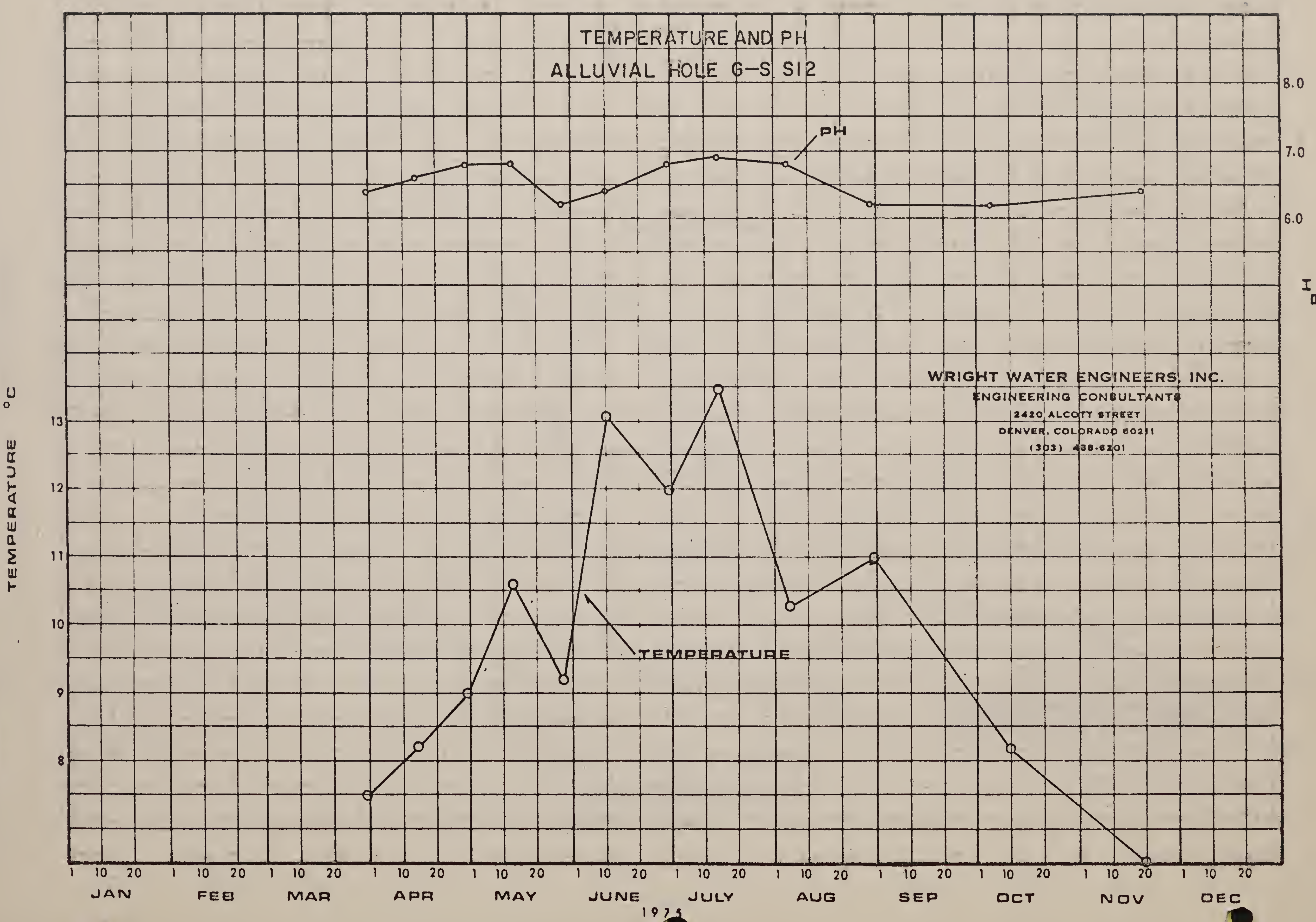

TEMPERATURE AND PH
ALLUVIAL HOLE G-S S12
PH
TEMPERATURE
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
8.0
7.0
6.0
pH
13
12
11
10
9
8
TEMPERATURE °C
1 10 20 JAN
1 10 20 FEB
1 10 20 MAR
1 10 20 APR
1 10 20 MAY
1 10 20 JUNE
1 10 20 JULY
1 10 20 AUG
1 10 20 SEP
1 10 20 OCT
1 10 20 NOV
1 10 20 DEC
1975

Figure 1.2-59

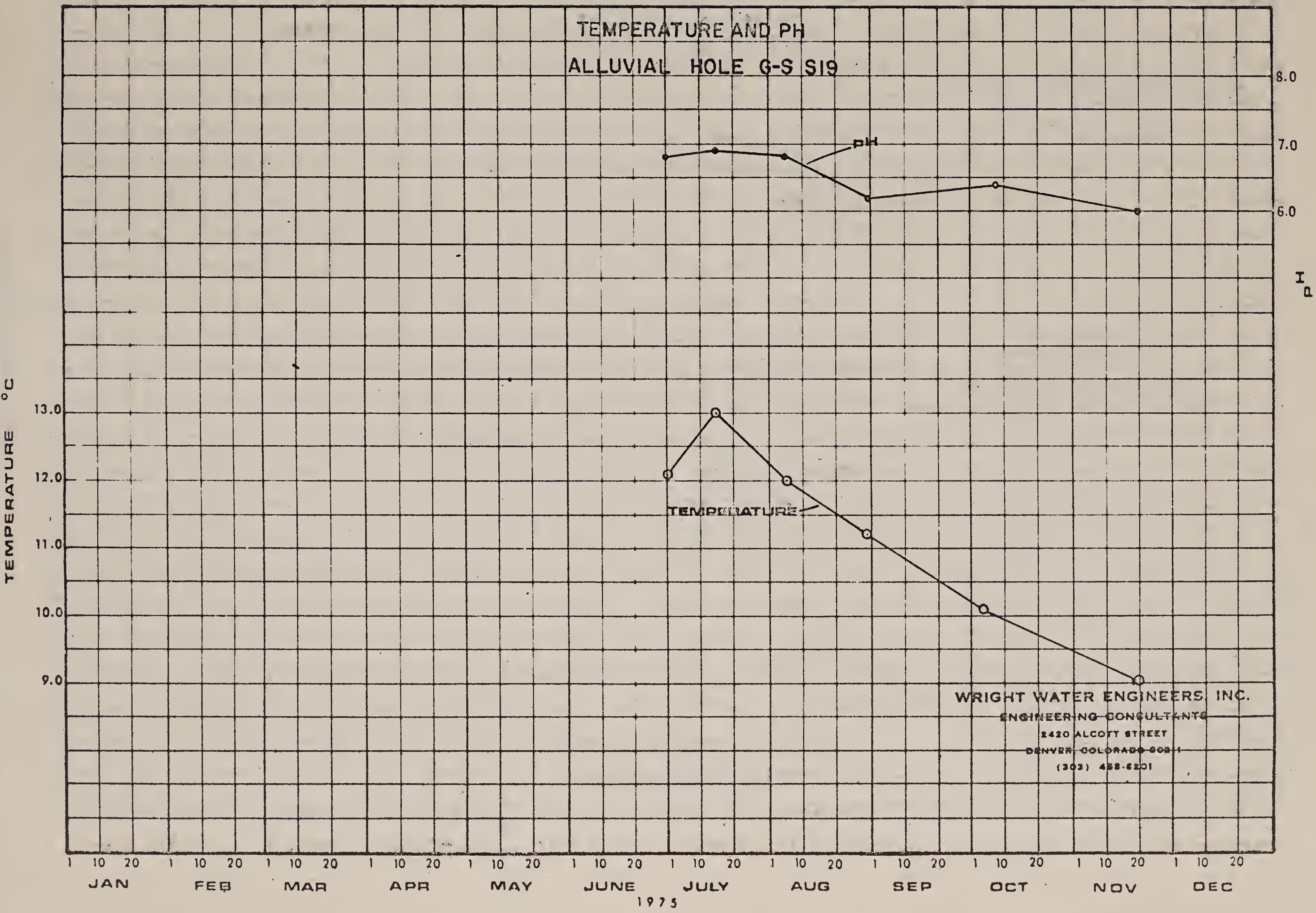
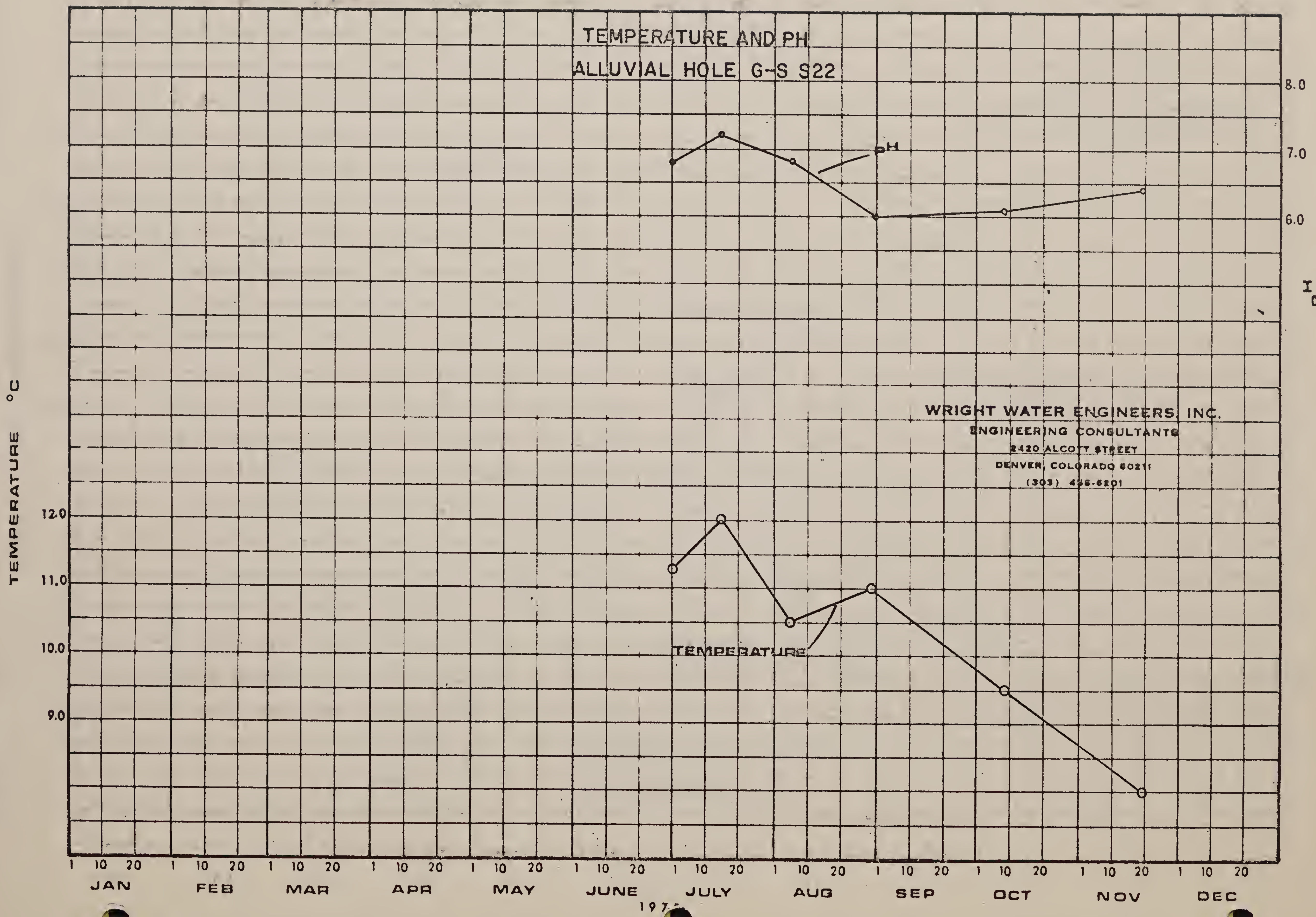

TEMPERATURE AND PH
ALLUVIAL HOLE G-S S19
pH
TEMPERATURE
8.0
7.0
6.0
pH
TEMPERATURE °C
13.0
12.0
11.0
10.0
9.0
1 10 20 JAN
1 10 20 FEB
1 10 20 MAR
1 10 20 APR
1 10 20 MAY
1 10 20 JUNE
1 10 20 JULY
1 10 20 AUG
1 10 20 SEP
1 10 20 OCT
1 10 20 NOV
1 10 20 DEC
1975
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201

Figure 1.2-60


TEMPERATURE AND PH
ALLUVIAL HOLE G-S S22
8.0
7.0
6.0
pH
pH
TEMPERATURE °C
12.0
11.0
10.0
9.0
TEMPERATURE
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 455-6201
1 10 20
JAN
FEB
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JUNE
JULY
AUG
SEP
OCT
NOV
DEC
197

Figure 1.2-61

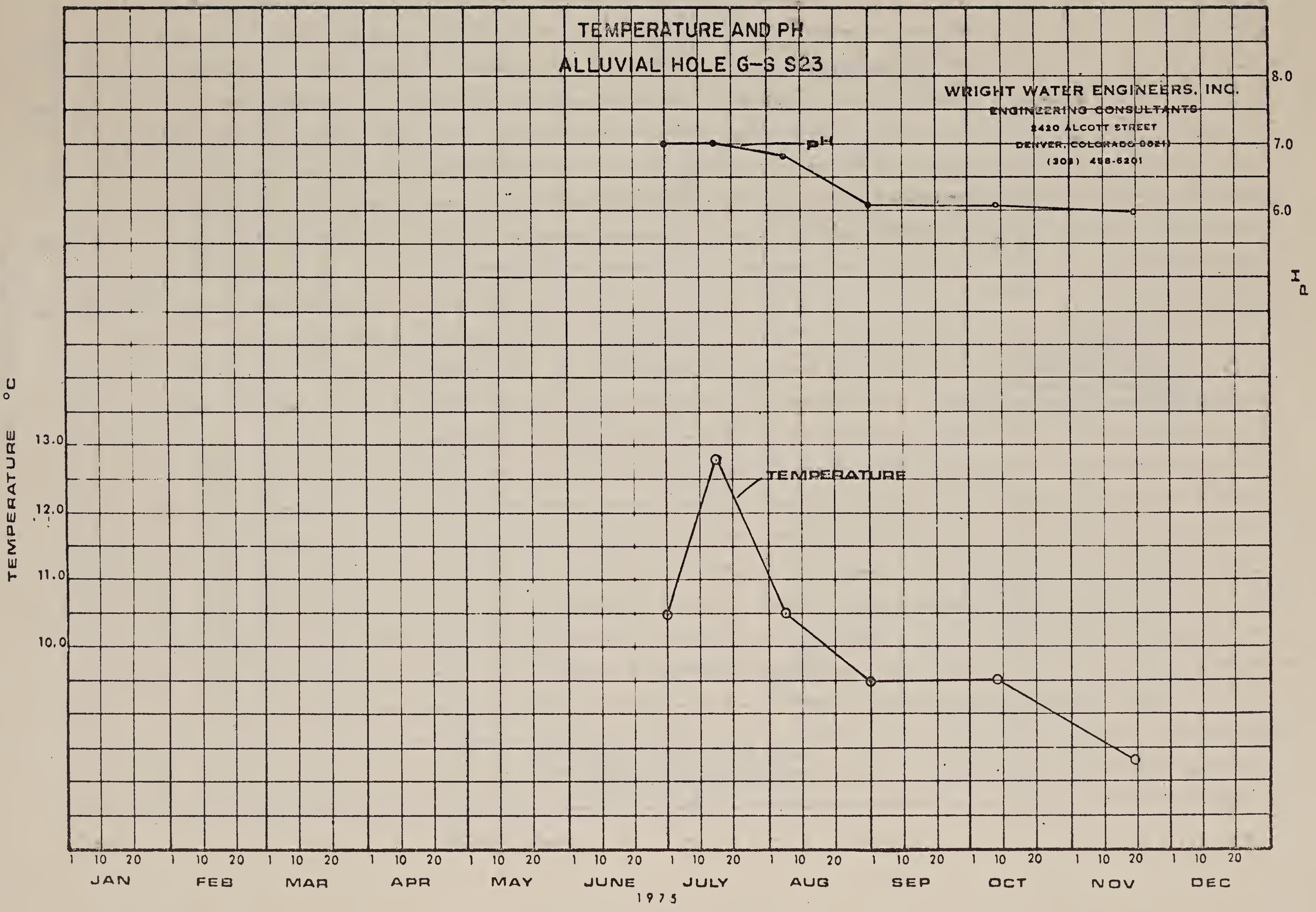
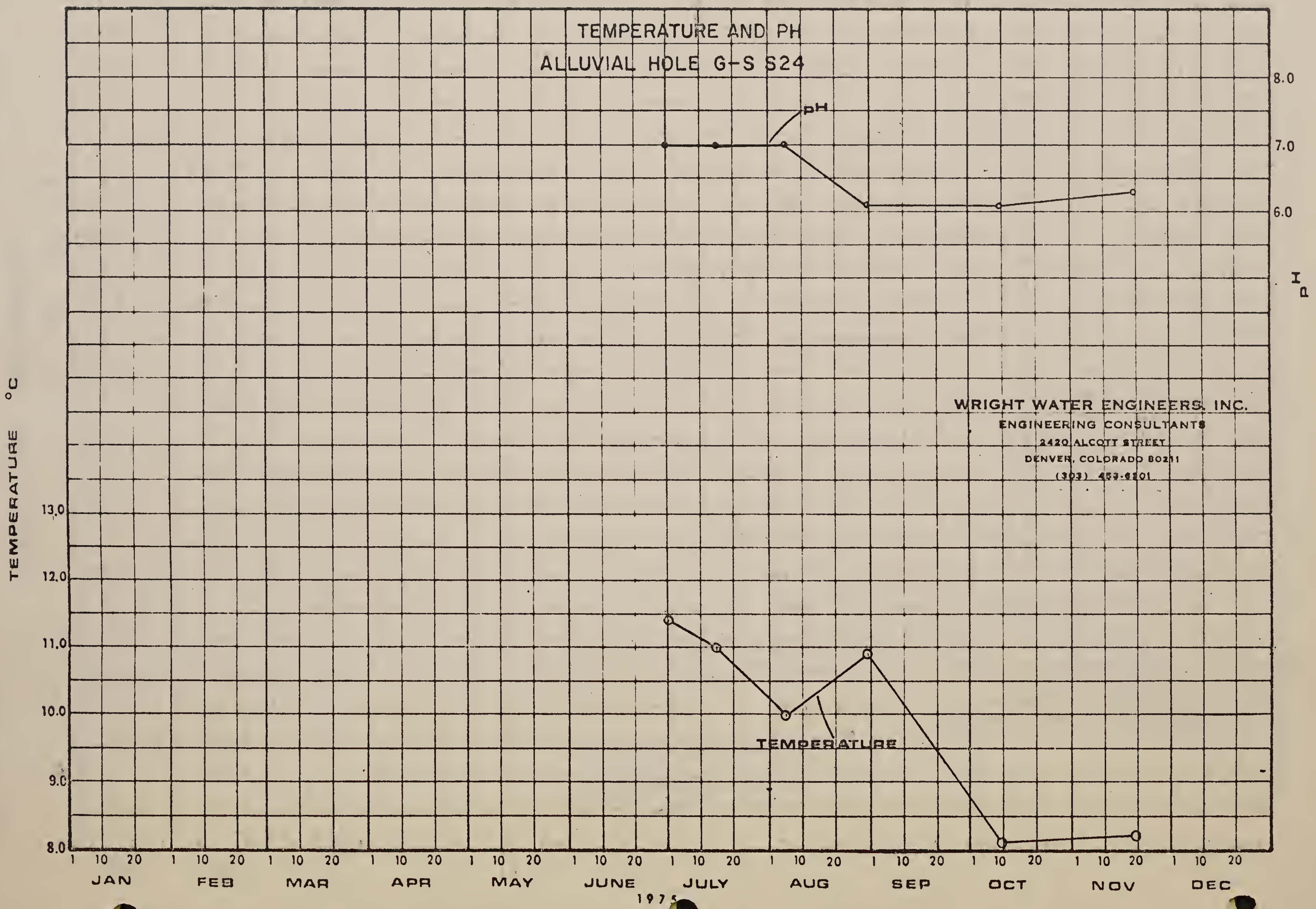

TEMPERATURE AND PH
ALLUVIAL HOLE G-S S23
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
pH
TEMPERATURE
8.0
7.0
6.0
pH
TEMPERATURE °C
13.0
12.0
11.0
10.0
1 10 20
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
1975

Figure 1.2-62


TEMPERATURE AND PH
ALLUVIAL HOLE G-S S24
pH
8.0
7.0
6.0
pH
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201
TEMPERATURE °C
13.0
12.0
11.0
10.0
9.0
8.0
TEMPERATURE
1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20 1 10 20
JAN
FEB
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DEC
1975

Figure 1.2-63

1.2.4 DEEP AQUIFER DRILLING PROGRAM

Drilling and coring in the Tract C-a area (commencing with G-S 6 and ending with G-S M5) occurred in July, 1974 through June, 1975. During this period, thirteen core holes, five monitor holes north of the tract, and four large diameter holes were drilled or cored. Several categories of hydrologic data were collected during this program. These data included: water production and quality, informal pumping test data, and production logging information. The method and intervals at which these data were collected were based upon the AOSS stipulations and approvals of the drilling program and major knowledge from prior investigations. This information was previously discussed in RBOSP Progress Report 2 and 4.

The best and most economical method for gathering hydrological data in the Piceance Creek Basin is the air rotary drilling method. Two air rotary rigs were used throughout the drilling and coring program. These were the Carmack Rig No. 10 and the Dreiling Rig No. 1. Western Air Company supplied two primary air compressors and one booster for each drilling rig. A mixture of water and biodegradable soapy substance was injected with the air to help lubricate the bit and lift the cuttings. The coring was with a 6-3/4-inch x 3-1/2-inch diamond core bit. For the majority of the holes, a 60-foot core barrel was used.

1.2.4.1 Terms Used

The following definitions of the terms will be helpful to the reader not familiar with hydrologic reports.

1. Aquifer: A stratum or zone below ground level that contains sufficient saturated permeable material to yield significant quantities of water to wells or springs.

2. Discharge: The rate of flow from the test hole in gallons per minute (gpm).

   1 cubic foot per sec. (cfs) = 449 gpm
   1 barrel per hour (bph) = 0.70 gpm
   1 gallon per min. (gpm) = 1.43 bph
   1 barrel = 42 gallons

3. Drawdown: The decrease in the static head of water of the aquifer due to pumping.
4. Specific Capacity: The discharge from the testhole divided by the drawdown (gpm/ft).
5. Coefficient of Permeability: The rate of flow in gallons per day (gpd) through a one square foot cross-sectional area of the aquifer under a hydraulic gradient of one foot per foot (gpd/ft^2).
6. Coefficient of Transmissivity: The rate of flow in (gpd) through a vertical strip of the aquifer one foot wide extending the full saturated height of the aquifer under a hydraulic gradient of one foot per one foot (gpd/ft).
7. Coefficient of Storage: The volume of water released or taken into storage, per unit surface area, when the head on the aquifer is changed by one unit: or the amount of water released from one square foot column of saturated aquifer, in place, when the head on this column is reduced by one foot. The coefficient of storage is referred to as the specific yield or drainable porosity for water table conditions in an aquifer.
8. Artesian Conditions: The condition where the piezometric water level is higher than the top of the aquifer, that is, water pressure within a confined aquifer causes water to rise, in a test hole, above the top of the aquifer.
9. Water Table Conditions: The case where the water level is equal to or lower than the top of the aquifer.

1.2.4.2 Water Production

Water production was monitored throughout drilling. Two aquifer systems in this area were identified. These systems were then delineated and separated on the basis of differences in water quality and temperature.

The upper aquifer describes a water-bearing zone of similar water quality and temperature characteristics which has an upper stratigraphic limit above the Mahogany Zone and a lower limit as far down as the R-5 Zone. The lower aquifer describes a water-bearing zone with similar water quality and temperature characteristics in the vicinity of the R-3 Zone and the Blue Marker. With the exception of the G-S 4-5, the water flow in the bore hole after drilling was from the upper aquifer to the lower aquifer. Production from the upper aquifer varied from as little as 40 gallons per minute (gpm) to over 1,000 gpm, with an average maximum of 247 gpm. Water produced from below the top of the lower aquifer, which included production from both aquifers, varies from 150 gpm to over 1,000 gpm. The average maximum of combined production was 438 gpm. Table 1.2- is a summary of all of the core holes and drill holes drilled in and around Tract C-a.

1.2.4.3 Water Quality

Water quality samples were collected for standard wet chemical and spectrographic analyses generally four times during the drilling or coring of each hole. At 30 foot depth intervals, conductivity, pH and temperature were measured. Conductivity was obtained using an automatic temperature compensating instrument, and a standard conductivity meter. Temperature was measured with standardized mercury thermometers, and pH sensitive paper was used to measure the pH.

The conductivity for the upper aquifer ranged from less than 1000 to 1700 umhos/cm with an average of 1290 umhos/cm. Conductivity for the combined aquifers measured on Tract ranged from 1300 to 4600 umhos/cm. The average was 3940 umhos/cm. However, a maximum condictivity of 28,000 umhos/cm was recorded at G-S M3 in the 84 Mesa. The lower aquifer water is generally more alkaline than the upper aquifer water. The dissolved solids averaged

1160 mg/l for the upper aquifer and 2370 mg/l for combined aquifer water. The average water temperature from the upper aquifer varied from 54°F to 60°F, averageing 58°F while the combined aquifer temperature ranged from 59°F to 79°F.

1.2.4.4 Informal Pumping Tests

Informal pumping tests were conducted during drilling in order to define the transmissivity and the specific capacity of the aquifer properties. Approximate values were obtained during these tests because the pumping was short; the production rate was not constant; drilling occurred simultaneously with production; and aquifer intervals of various pressures were open to the bore holes. The Jacob's simplified method was used to approximate transmissivity and specific capacity from the production and recovery rates. The apparent transmissivities for the upper aquifer ranged from less than 1,000 gallons per day per foot (gpd/ft) to 20,000 gpd/ft. and averaged 5,140 gpd/ft. The apparent transmissivities for the combined aquifers ranged from less than 200 gpd/ft to approximately 12,000 gpd/ft. and averaged 3,089 gpd/ft. The apparent specific capacity averaged 1.3 gallons per minute per foot (gpm/ft) from the upper aquifer and 1.5 gpm/ft for the combined aquifer tests.

1.2.4.5 Geophysical Logs

A suite of bore hole geophysical electric logs were run after the the total depth of each hole was reached. For hydrological purposes, the spinner (a flow-meter propeller device which is turned by the force of the flowing water), and temperature surveys are of prime interest. While the spinner surveys are highly interpretive, the temperature surveys are straightforward.

The temperature survey indicates the water temperature in the bore holes versus depth. This data can be used in some cases to interpret the flow, being either downhole or uphole, zones where water is entering or leaving the borehole, or no flow at all.

The spinner survey, though interpretive, is more definitive of of direction and velocity of flow versus hole depth. Measurements are made from several runs. The flow rate versus depth can be calculated from these measurements, knowing the spinner tool specification and the bore hole size. The rate of water per foot of depth entering or leaving the bore hole can also be calculated.

Geophysical logs results indicate that, in general, the upper aquifer was found to be in the vicinity of the Mahogany Zone. The lower aquifer was generally in the vicinity of the R-3 zone and the Blue Marker Zone.

TABLE 1.2-10

DRILL HOLE COMPLETION SUMMARY

Thirty On-Tract Holes

Drill Hole	Completion	Drill Hole	Completion
G-S 1	U & L	Am 4	P & A
G-S 2-3	U & L	CE-701	Upper Aquifer Pump Test
G-S 4-5*	U & L*	CE-702	U & L
G-S 6	U & L	CE-703	P & A
G-S 7	P & A	CE-705-A	Upper Aquifer Pump Test
G-S 8	Lower Aquifer Only	CE-707	U & L
G-S 9	U & L	CE-708	U & L
G-S 10	U & L	CE-709	U & L
G-S 11	U & L	TO 1	U & L
G-S 12*	U & L*	TO 2	U & L
G-S 13	U & L	TO 3	U & L
G-S 14	P & A	G-S D16	Lower Aquifer Pump Test
G-S 15	U & L	G-S D17	Lower Aquifer Pump Test
Am 2-A	U & L	G-S D18	Lower Aquifer Pump Test
Am 3	U & L	G-S D19	Lower Aquifer Pump Test

Five Off-Tract Holes

Drill Hole	Completion
G-S M1	U & L
G-S M2	U & L
G-S M3	U & L
G-S M4	U & L
G-S M5	SA

Totals

Completions in Upper and Lower Aquifers	22
Completions in Upper Aquifer Only	4
Completions in Lower Aquifer Only	5
Holes Plugged and Abandoned	4
Total Number of Holes	35

Am = Amoco Production Company
CE = Cameron Engineers, Inc.
G-S = Gulf-Standard (Indiana)

TO = The Oil Shale Company
U & L = Upper & Lower Aquifer Completions
P & A = Plugged and Abandoned
SA = Shallowest aquifer

* Holes Temporarily Modified for Upper Aquifer Pump Testing

1.2.5 DEEP AQUIFER COMPLETION PROGRAM

The completion of thirty-four core and drill holes associated with Tract C-a are discussed in RBOSP Report 2. RBOSP Progress Report 4 described the completion of G-S M5. Following is a summary of the completion program.

The dual monitor hole completion design separates the upper and lower aquifers. This separation enables water levels to be monitored and water samples to be obtained. In each well completion process, a 200-foot long liner was cemented in place approximately 250 feet below the bottom of the upper aquifer. To separate the two aquifer systems, a 2-3/8-inch tubing was used to set the tension-type packer at about 30 feet below the top of the liner to act as a seal. To insure that data could be collected from the upper aquifer, a second string of 2-3/8-inch tubing was run down the holes.
In the smaller diameter Amoco and TOSCO holes, 1-1/2-inch tubing was run. Four core holes were plugged with cement. Table 1.2-11 provides a summary of the current status of the drill and core holes.

1.2.6 UPPER AND LOWER AQUIFER PUMPING TESTS

Four upper and four lower aquifer pumping tests were conducted to determine aquifer characteristics and water quality on an areal basis. The period of testing was from January through June, 1975.

The resulting aquifer characteristics are described in more detail in RBOSP Progress Reoprt 3 (Section 1.2.6) and Report 4 (Sections 1.2.6 and 1.2.8.6).

Submersible pumps were used. Pumping tests were conducted on the lower aquifer at G-S: D 17, D 16, D 19 and simultaneously at D 18 and D 19. Upper aquifer pumping tests were performed at TO 3, CE 705A, G-S 12 and G-S 4-5.

Monitoring of water quality, quantity, and of water drawdown and recovery in both the production and observation holes was performed. Air lines and electric water level indicators were used. Temperature, conductivity and pH were recorded during the pumping tests.

Generally, the upper aquifer water quality stabilized after the first day of pumping. The pH values averaged from 6.8 to 7.5. Temperatures between holes ranged from 14^{o}C to 23^{o}C. Conductivities were between 1350 umhos/cm and 1750 umhos/cm with the exception of TO 3 which averaged 3500 umhos/cm.

The lower aquifer water was of poorer quality. The pH values were stable at 7.5, except for G-S D 17 which fluctuated between 6.0 and 7.3. Temperatures ranged between 17^{o}C to 30^{o}C. Conductivities ranged from 1700 umhos/cm to 24000 umhos/cm except for the G-S D18 average of 5000 umhos/cm and a G-S D16 range of 3800 to 4200 umhos/cm.

Values of transmissivity and coefficients of storage for all affected holes were computer processed using the Jacob's method, comiled and then printed.

Upper aquifer test results from nearby holes indicate an average transmissivity and storage of 15,316 gpd/ft and 6.8×10^{-5} respectively during drawdown, and 16,909 gpd/ft and 5.97×10^{-5} for recovery.

Lower aquifer pumping tests affected the general area. Transmissivities during drawdown average 9572 gpd/ft with storage coefficients averaging 2.0×10^{-4}. Recovery values average 31,822 gpd/ft for transmissivity with a 9.52×10^{-4} storage coefficient. Drawdown and recovery differences may be due to dewatering of the upper aquifer. A step drawdown test indicated a transmissivity of 15,538 gpd/ft at G-S D16. Table 1.2-11 is a schedule of the pumping tests showing the pumping rates and time.

Geophysical well logs were run in selected holes to determine the aquifer nature on a foot by foot basis. The surveys included temperature, acoustic flow, and radioactive tracer.

TABLE 1.2- 11
PUMPING RATES & TIMES

Pumped Hole	Date Pump Turned On	Time Pump Turned On	Date Pump Turned Off	Time Pump Turned Off	Gallons Pumped per Minute	Total Time of Pumping (Min.)
Upper Aquifer						
CE-705-A	2/26/75	1230	3/08/75	0850	72	14180
CE-705-A	3/19/75	0905	3/22/75	1405	264	4620
CE-705-A	3/25/75	0825	4/01/75	1515	259	10490
GS-4-5	5/02/75	0945	5/19/75	0715	81.3	24330
GS-12	4/02/75	1045	4/13/75	0845	64.3	15720
TO-3	1/07/75	1000	1/28/75	1310	76.7	30430
Lower Aquifer						
GS-16	2/11/75 (Step Drawdown)	0945	2/11/75	1800	151 200 250	495
GS-16	2/15/75	1300	3/09/75	1230	123	31650
GS-17	1/06/75	1600	1/11/75	0928	275	6808
GS-17	1/18/75	1300	2/03/75	0830	275	22770
GS-18	5/21/75	1030	6/05/75	1100	174	21630
GS-19	4/08/75	1100	5/05/75	0030	667	38250
GS-19	5/20/75	1000	5/26/75	0655	667	8455

1.2.7 DEEP AQUIFER MONITORING

The deep aquifer monitoring program first started in December, 1974. Early data included measuring the static water levels and dynamic water levels subsequent to pumping tests. The sampling program began in March, 1975. Water samples were collected monthly for a period of six months (March through August, 1975). Field measurements included temperature, pH and specific conductivity. Water samples were further analyzed for individual chemical constituents. Monitoring procedures and previous results of chemical analyses were presented in RBOSP Progress Reports 3 and 4.

As per RBOSP Approved Exploratory Plan, the present monitoring program consists of measuring static water levels and temperature on a monthly basis. Water samples are now collected semi-annually.

The results of the water quality monitoring program are summarized in Table 1.2-12 which indicates a low, high and average value for each of the chemical constituents. Table 1.2-13 is a summary of the spectrographic analysis and has dashed lines where the element was either not present or below detectable limits. The word "major" indicates concentrations too high to be quantified.

Figure 1.2-64 and 1.2-65 are plots of the recent piezometric levels for the upper and lower aquifers, and Figure 1.2-66 shows the locations of all the monitoring holes.

TABLE 1.2-12

SUMMARY OF WET CHEMICAL ANALYSIS
MONITORING PROGRAM
UPPER AND LOWER AQUIFER
TRACT C-a and VICINITY

MARCH TO AUGUST, 1975

Item	LOWER AQUIFER			No. of Items Avg'd.	UPPER AQUIFER			No. of Items Avg'd.
	Low	High	Average		Low	High	Average	
Aluminum	-0.100	0.600	0.178	9	-0.100	1.000	0.144	17
Ammonia	-0.100	9.600	0.697	79	-0.100	1.800	0.394	119
Arsenic	-0.010	0.030	0.000	80	-0.010	0.040	0.001	123
Bicarbonate	260.000	2980.000	1074.438	80	85.000	2760.000	622.992	123
Cadmium	-0.010	0.010	0.001	80	-0.100	0.100	0.002	123
Calcium	0.800	115.000	19.570	80	-0.010	260.000	64.512	123
Carbonate	-0.100	710.000	102.192	80	-0.100	335.000	24.969	123
Chloride	1.400	160.000	31.006	80	-1.000	87.000	17.115	123
Chromium	-0.050	-0.010	--	78	-0.050	0.050	--	122
Copper	-0.100	0.300	0.027	80	-0.100	0.800	0.029	123
Fluoride	0.200	85.000	15.070	80	0.100	60.000	3.300	123
Hydroxide	--	--	--	0	--	--	--	0
Iron	-0.050	16.200	4.156	80	-0.050	18.000	6.170	123
Lead	-0.100	26.000	1.157	80	0.010	3.800	0.434	123
Magnesium	2.400	130.000	33.292	80	3.500	155.000	56.163	123
Mercury	-0.010	0.002	--	80	-0.010	0.045	--	123
Nitrate	-0.100	2.000	0.387	80	-0.100	7.000	0.568	123
Phosphate	-0.100	0.700	0.037	80	-0.100	1.000	0.023	123
Potassium	--	--	--	0	--	--	--	0
Selenium	-0.100	-0.010	--	80	-0.010	-0.001	--	123
Silicone Dioxide	-0.100	32.000	9.670	80	-0.100	58.000	27.076	123
Sodium	155.000	1560.000	527.500	80	110.000	1170.000	279.024	123
Sulfate	-4.000	600.000	190.887	80	-4.000	900.000	356.748	123
Sulfide	--	--	--	0	26.000	26.000	26.000	1
Zinc	-0.100	68.000	1.675	80	-0.100	15.000	0.796	123
Gross Alpha	0.100	30.000	5.765	72	0.200	29.000	5.334	97
Gross Beta	3.000	830.00	49.432	37	2.000	73.000	22.464	28
Hardness	20.000	690.000	185.313	80	32.000	1110.000	396.244	123
pH	6.000	11.000	7.324	80	6.000	8.800	6.789	123
Conductance	900.000	5180.000	2096.662	80	810.000	4200.000	1584.935	123
Dissolved Solids	630.000	3640.000	1460.313	80	540.000	2850.000	1147.642	123
Manganese	-0.050	0.500	0.093	80	-0.050	1.000	0.174	123
Alkalinity	52.000	4500.000	975.989	80	70.000	2360.000	535.834	123
Cyanide	-0.010	0.030	0.000	79	-0.010	-0.010	--	122
Boron	-0.100	9.400	1.479	80	-0.100	4.800	0.681	123
Barium	-1.000	-0.100	--	80	-1.000	-0.100	--	123
Silver	-0.010	0.100	0.002	80	-0.100	0.100	0.006	123
Nickel	-0.100	0.100	0.026	80	-0.010	0.200	0.027	123
Lithium	--	--	--	0	--	--	--	0
TOC	3.000	73.000	12.613	71	1.000	50.000	10.538	106

-- Less than minimum detectable amount

TABLE 1.2-13

SUMMARY OF SPECTROGRAPHIC ANALYSIS
MONITORING PROGRAM
UPPER AND LOWER AQUIFER
TRACT C-a and VICINITY

MARCH TO AUGUST, 1975

	LOWER AQUIFER				UPPER AQUIFER			
Item	Low	High	Average	No. of Items Avg'd.	Low	High	Average	No. of Items Avg'd.
Aluminum	0.001	1.000	0.077	80	0.001	1.000	0.122	123
Antimony	0.200	0.200	0.200	1	--	--	--	0
Arsenic	--	--	--	0	--	--	--	0
Barium	0.001	0.010	0.002	13	0.001	0.010	0.003	22
Berylium	--	--	--	0	--	--	--	0
Bismuth	--	--	--	0	--	--	--	0
Boron	0.100	0.500	0.351	78	0.100	2.000	0.363	123
Cadmium	--	--	--	0	--	--	--	0
Calcium	0.100	Major	5.265	23	1.000	Major	7.882	17
Cerium	--	--	--	0	--	--	--	0
Cesium	--	--	--	0	--	--	--	0
Chromium	--	--	--	0	--	--	--	0
Cobalt	--	--	--	0	--	--	--	0
Columbium	--	--	--	0	--	--	--	0
Copper	0.001	0.020	0.005	71	0.001	0.020	0.006	113
Dysprosium	--	--	--	0	--	--	--	0
Erbium	--	--	--	0	--	--	--	0
Europium	--	--	--	0	--	--	--	0
Gadolinium	--	--	--	0	--	--	--	0
Gallium	--	--	--	0	--	--	--	0
Germanium	--	--	--	0	--	--	--	0
Gold	--	--	--	0	--	--	--	0
Hafnium	--	--	--	0	--	--	--	0
Holmium	--	--	--	0	--	--	--	0
Indium	--	--	--	0	--	--	--	0
Iridium	--	--	--	0	--	--	--	0
Iron	0.010	0.500	0.046	78	0.010	1.000	0.094	122
Lanthanum	--	--	--	0	--	--	--	0
Lead	0.000	0.500	0.073	10	0.001	0.200	0.027	21
Lithium	0.001	0.100	0 011	63	0.001	0.500	0.015	92
Lutetium	0.010	0.010	0.010	1	0.001	0.010	0.005	2
Magnesium	0.100	Major	2.764	22	0.100	Major	6.006	18
Manganese	0.001	0.100	0.013	63	0.001	0.200	0.020	105
Mercury	--	--	--	0	--	--	--	0
Molybdenum	0.001	0.100	0.007	31	0.001	0.500	0.020	62
Neodymium	--	--	--	0	--	--	--	0
Nickel	--	--	--	0	--	--	--	0
Osmium	--	--	--	0	--	--	--	0
Palladium	--	--	--	0	0.100	0.100	0.100	1
Platinum	--	--	--	0	--	--	--	0
Potassium	0.050	5.000	1.099	78	0.100	5.000	1.054	122
Praseodymium	--	--	--	0	--	--	--	0
Radium	0.090	0.900	0.375	24	0.100	0.800	0.200	26
Rhenium	--	--	--	0	--	--	--	0
Rhodium	--	--	--	0	--	--	--	0
Rubidium	--	--	--	0	--	--	--	0
Ruthenium	--	--	--	0	--	--	--	0
Samarium	--	--	--	0	--	--	--	0
Scandium	--	--	--	0	--	--	--	0
Selenium	--	--	--	0	--	--	--	0
Silicon	-0.500	10.000	4.287	80	1.000	20.000	5.268	123
Silver	0.000	0.001	0.001	6	-0.001	0.001	0.001	12
Sodium	2.000	Major	6.791	43	2.000	Major	6.843	83
Strontium	0.001	1.000	0.096	70	0.001	1.000	0.109	113
Tantalum	--	--	--	0	--	--	--	0
Terbium	--	--	--	0	--	--	--	0
Thallium	--	--	--	0	--	--	--	0
Thorium	--	--	--	0	--	--	--	0
Thulium	--	--	--	0	--	--	--	0
Tin	--	--	--	1	0.001	0.001	0.001	1
Titanium	0.001	0.010	0.003	38	0.001	0.020	0.004	73
Tungsten	--	--	--	0	--	--	--	0
Uranium	-1.500	-1.500	--	1	--	--	--	0
Vanadium	--	--	--	0	--	--	0.001	1
Ytterbium	--	--	--	0	--	--	--	0
Yttrium	--	--	--	0	--	--	--	0
Zinc	0.001	0.200	0.014	17	0.001	0.200	0.015	38
Zirconium	--	--	--	0	--	--	--	0

-- Less than minimum detectable amount

Major - Concentration too large to quantify (see wet chemical analyses)

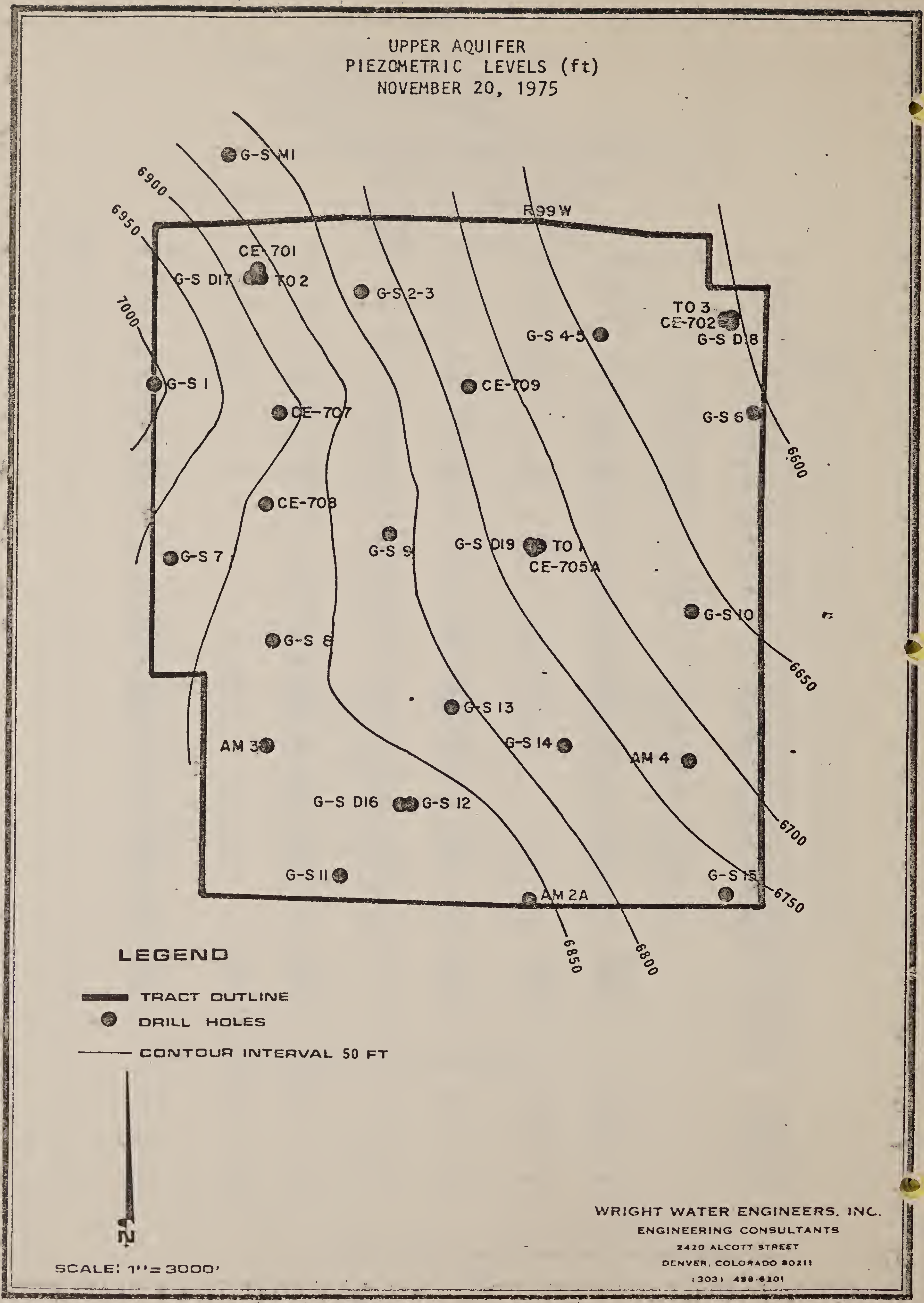
UPPER AQUIFER
PIEZOMETRIC LEVELS (ft)
NOVEMBER 20, 1975
G-S M1
6900
6950
7000
R99W
CE-701
G-S D17
TO 2
G-S 2-3
TO 3
CE-702
G-S D18
G-S 4-5
G-S 1
CE-709
CE-707
G-S 6
6600
CE-708
G-S 9
G-S D19
TO 1
CE-705A
G-S 7
G-S 10
6650
G-S 8
G-S 13
AM 3
G-S 14
AM 4
G-S D16
G-S 12
6700
G-S 11
G-S 15
6750
AM 2A
6850
6800
LEGEND
TRACT OUTLINE
DRILL HOLES
CONTOUR INTERVAL 50 FT
N
SCALE: 1''=3000'
WRIGHT WATER ENGINEERS, INC.
ENGINEERING CONSULTANTS
2420 ALCOTT STREET
DENVER, COLORADO 80211
(303) 458-6201

Figure 1.2-64

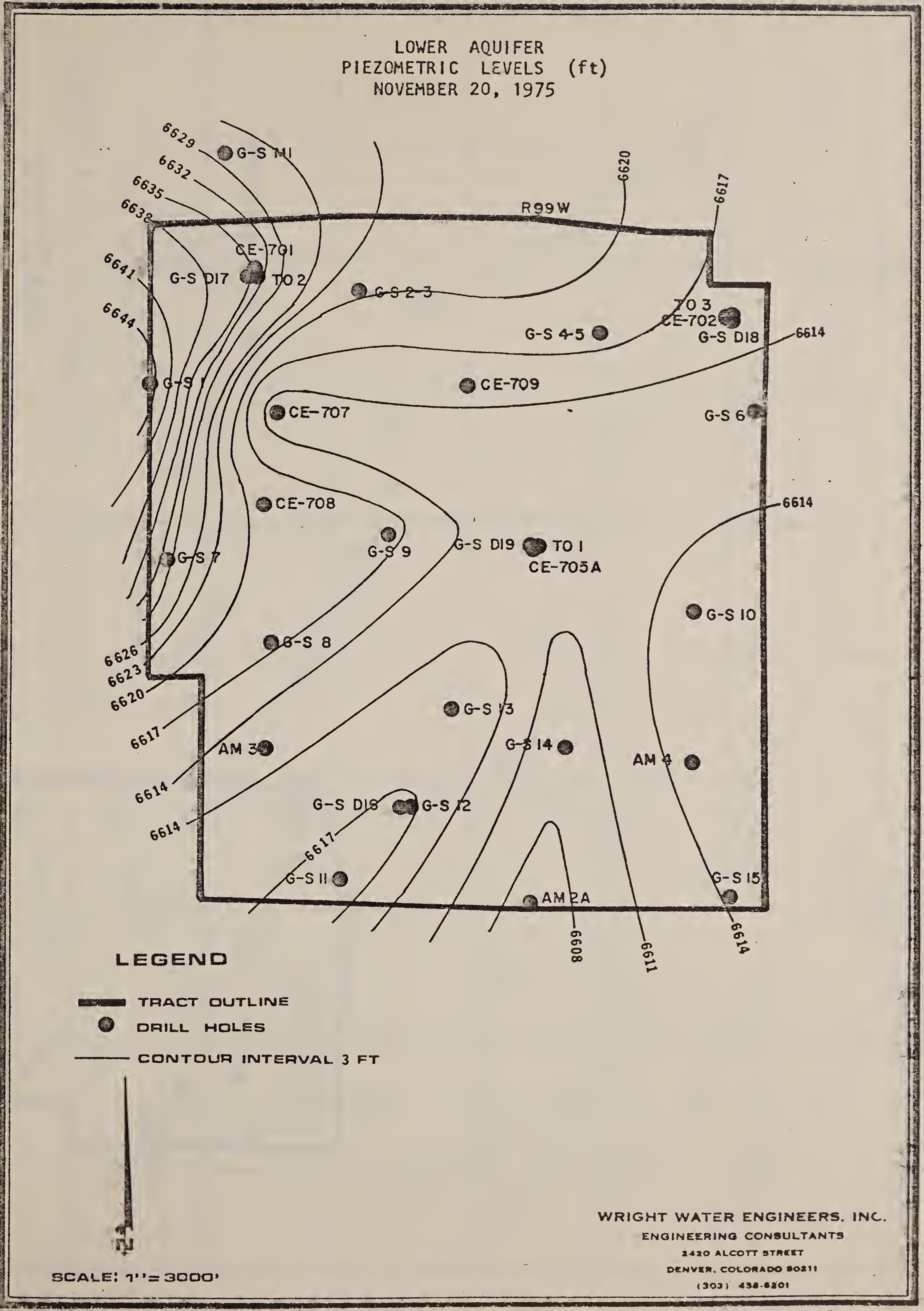
LOWER AQUIFER
PIEZOMETRIC LEVELS (ft)
NOVEMBER 20, 1975

Figure 1.2-65

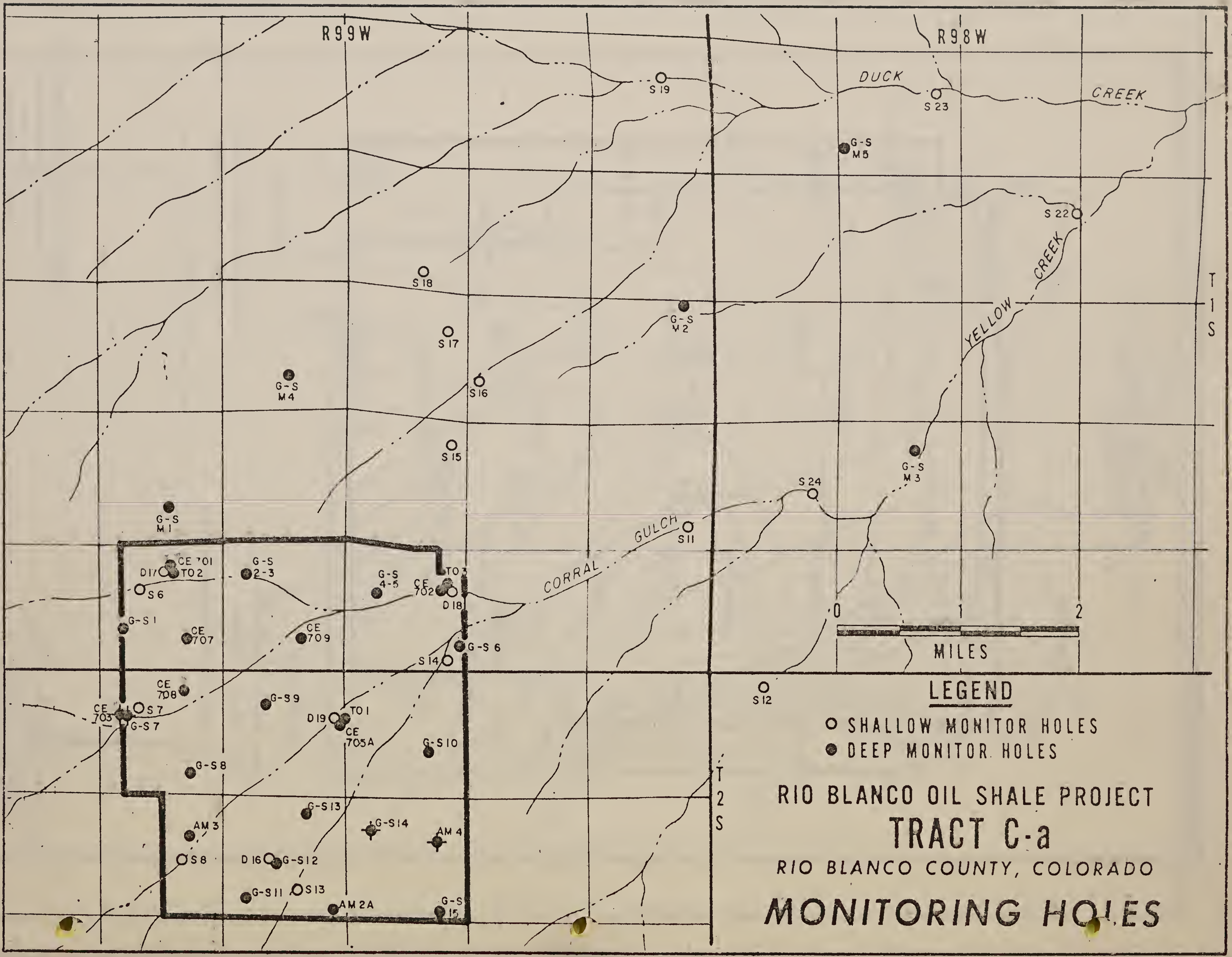
R99W
R98W
T1S
T2S
DUCK CREEK
YELLOW CREEK
CORRAL GULCH
S19
S23
G-S M5
S22
S18
G-S M2
S17
G-S M4
S16
S15
G-S M3
S24
S11
G-S M1
CE 701
T02
D17
S6
G-S 2-3
G-S 4-5
CE 702
T03
D18
G-S 1
CE 707
CE 709
G-S 6
S14
CE 708
CE 703
S7
G-S 7
G-S 9
D19
T01
CE 705A
G-S 10
G-S 8
G-S 13
G-S 14
AM 4
AM 3
S8
D16
G-S 12
G-S 11
S13
AM 2A
G-S 15
S12
0
1
2
MILES
LEGEND
○ SHALLOW MONITOR HOLES
● DEEP MONITOR HOLES
RIO BLANCO OIL SHALE PROJECT
TRACT C-a
RIO BLANCO COUNTY, COLORADO
MONITORING HOLES

Figure 1.2-66

TRACT C-a

MONITORING WELLS

1.2.8 HYDROLOGIC PROGRAM SUMMARY AND ANAYLSIS

The following presents a summary of, and conclusions from, various hydrologic studies pertinent to Tract C-a development. The analyses will be presented under three main categories: surface water, alluvial aqifers and deep aquifers.

1.2.8.1 Surface Water

A total of eleven stream gaging stations have been built and monitored on all significant surface drainages associated with Tract C-a. These gaging stations are equipped with automatic samplers and are capable of measuring continuous flow, temperature, conductivity, sediment concentration and discharge. All of the streams on Tract C-a can be classified as intermittent; however, some reaches are perennial.

Seasonal fluctuations in streamflows are noted at stations in Box Elder Gulch, Corral Gulch and Yellow Creek near White River. Box Elder Gulch near the west line of Tract C-a remains dry during most of the year with its maximum stream discharge occurring in May and June. Corral Gulch near the west line of the Tract has its peak flow in May or June. Flow rate in Corral Gulch east of the tract generally increases in May while Yellow Creek near White River has its maximum stream discharges around March. Seasonal fluctuation in streamflows is apparently associated with the spring snowmelts of the region. Sediment concentration and discharge vary accordingly with streamflows.

Water quality data from various surface gaging stations associated with Tract C-a indicated substantial constituent variations. In general, the quality deteriorates as the streams flow downstream from the vicinity of the Tract to Yellow Creek near the White River. Water samples collected at Box Elder Gulch and Corral Gulch near the west line of Tract C-a showed very good quality with a relatively high turbidity. These sources are typically associated with precipitation and snowmelt runoff.

At Corral Gulch station east of the tract and Corral Gulch south of 84 Mesa, the water quality starts to decrease. Constituents that increase in concentrations include bicarbonate, magnesium, sodium,sulfate and total dissolved solids. It appears that the stream, with a much lower turbidity, has collected its contaminants along its flow path.

At the Yellow Creek station near the White River, water quality varies substantially from those recorded upstream. Alkalinity, conductivity, and total dissolved solids increase to about four times those measured near the Tract. Noticeable increases in concentrations are observed for bicarbonate, chlorine, boron, fluoride, magnesium, sodium and silica. These changes in water chemistry support the contention that the streamflow at Yellow Creek near the White River is largely fed by ground water inflows to various tributaries.

Six rain gaging stations are located on or near Tract C-a. Precipitation data indicated that localized thunderstorms and snowfalls are a major source of the precipitation in the area studied.

Precipitation values of about 8 inches from January through November were recorded on Tract C-a. The wettest month was usually October with other high amounts recorded in March, May and July. Minimum values usually occurred in a period from late August through September. Other low amounts occurred from January through early February.

Table 1.2-14 is the summary of the precipitation data for 1975.

Precipitation data comparison between recording and storage gages show consistently lower average values from the storage gages. This is attributed mainly to evaporative losses from the storage gages in July, although some of the difference may be due to topographical effects.

TABLE 1.2-14

SUMMARY OF PRECIPITATION DATA FOR 1975

Storage-Type Rain Gage Locations*	Precipitation Monthly (inches)	Precipitation Total - Jan. thru mid-Nov.
1. Dry Fork near west line Tract C-a	.69	7.55
2. Box Elder Gulch near west line Tract C-a	.81	8.85
3. Corral Gulch near west line Tract C-a	.75	8.24

Recording-Type Rain Gage Locations	Precipitation Monthly (Inches) Max	Min	Avg	Total - Jan. thru Oct.
4. Stake Springs Draw near confluence w/Corral Gulch	2.43	0.06	1.28	12.77
5. Yellow Creek near White River	1.91	0.04	1.05	10.51
6. Cathedral Bluffs located in NW¼, NW¼, Sec. 14, T2S, R100W	2.49	0.43	1.64	14.79**

* Affected by evaporation during July

** 9 months' data

1.2.8.2 Alluvial Aquifers

Water levels of alluvial aquifers generally decreased from January through April of 1975. Water level increases during May and June were apparently due to infiltration of increased runoff from snowmelt. The magnitude of the increase depended upon the particular drainage system. Water levels generally dropped after July; exceptions to this were G-S S-19, and G-S S-7. Water level changes have ranged as high as 14 feet, but averaged 7 feet for the original seven alluvial holes completed in early 1975. Some increases in G-S S-11 in May were attributed to D-19 pumping test discharge.

Conductivity has generally been stable, with some increase and decrease noted during June and July. The fluctuation is apparently affected by peak surface sediment loads which occurred in April, May and early June. The declining period in conductivity has been associated with constant to slightly-increasing concentrations of total dissolved solids (TDS) which may indicate a change in water composition during these periods.

The pH values showed some variability during late May through August. The yearly trend, as with conductivity, follows yearly surface flow and sediment loads. Low values in pH are noted in late May and early June, with a recovery to yearly high values occurring in July and August.

Temperature values reflect yearly ambient trends and surface flow trends. Low values occur from December through March. The warm period was in June and July. However, the climbing trend from March through July was broken in May and June by the effects of increasing snowmelt and surface flow.

Total dissolved solids are relatively constant over the period for individual alluvial aquifer holes. The samples indicate considerable monthly ranges in chemical composition. The alluvial aquifer water has approximately the same concentration of total dissolved solids as the upper aquifer water, however, their chemical compositions are different. The upper aquifer has a higher percent sodium than does the alluvial aquifer. Sulfate is a larger part of total anions in the alluvial aquifer water, compared to the upper aquifer water. There is generally an increase in total dissolved solids down-stream in the alluvial aquifer water.

1.2.8.3 Deep Aquifer

Two major aquifer systems are found in the oil shale interval under Tract C-a. The upper aquifer exists in the vicinity of the Mahogany Zone. The lower aquifer system is associated with the R-3 zone and in some cases is as deep as the Blue Marker.

In general, the upper aquifer water near the east side of the tract has a higher dissolved solids content and some higher chemical constituent values than on the west side of the tract. Several constituents increase in concentration two to three times from west to east across the tract. These include total dissolved solids, alkalinity, bicarbonate, sodium and magnesium. The upper aquifer water quality is comparable to that of the lower aquifer water in the northeast section of the tract. Apparently, it is associated with the hydrologic connection of the two aquifer systems in the area.

In the lower aquifer, water quality decreases as groundwater moves down gradient from west to east. Significant changes in concentration include total dissolved solids, alkalinity, bicarbonate, boron, magnesium, sodium and sulfate.

High iron content in the upper and lower aquifer systems is thought to be due to a chemical reaction between the casing and the aquifer water.

Potentiometric levels have been fluctuating with time. In general, the upper aquifer showed minor changes in the northeast part of the tract. An average increase of approximately 1-1/2 feet was observed near the southern line of Tract C-a. The greatest increase was noted in the northwest corner except for CE-708.

Piezometric levels for the lower aquifer have dropped on the order of 2 to 3 feet across the tract since August, 1975. Maximum decreases were generally observed in the northwest section of the Tract. This observed change in the piezometric levels is thought to be due to the aquifers recovery from the interconnection of the two aquifers by prelease exploration holes. Generally, the in-hole flow was from the upper aquifer to the lower aquifer. The result was the creation of a depression in the pre-1971 upper aquifer potentiometric surface, and a mound in the lower aquifer pre-1971 potentiometric surface. Since the separation of the two aquifers by RBOSP in the fall of 1974, the aquifers have been recovering toward their pre-1971 steady state levels. Thus, the observed raise in the upper aquifer levels and decline in the lower aquifer levels.

Pumping test results indicate that faulting appears to hinder water flow in the upper aquifer. Upper aquifer apparent transmissivities ranges from 1000 gpd/ft to 5000 gpd/ft, progressing in an eastward direction over the tract. Lower aquifer transmissivity over Tract C-a shows a bowl-like low of 5250 gpd/ft centered at G-S 12, and a high of 7500 gpd/ft along the rim, or tract boundary.